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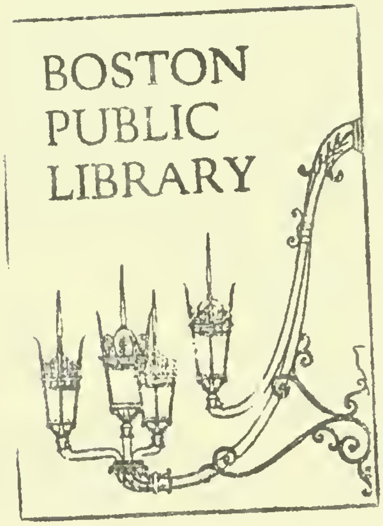

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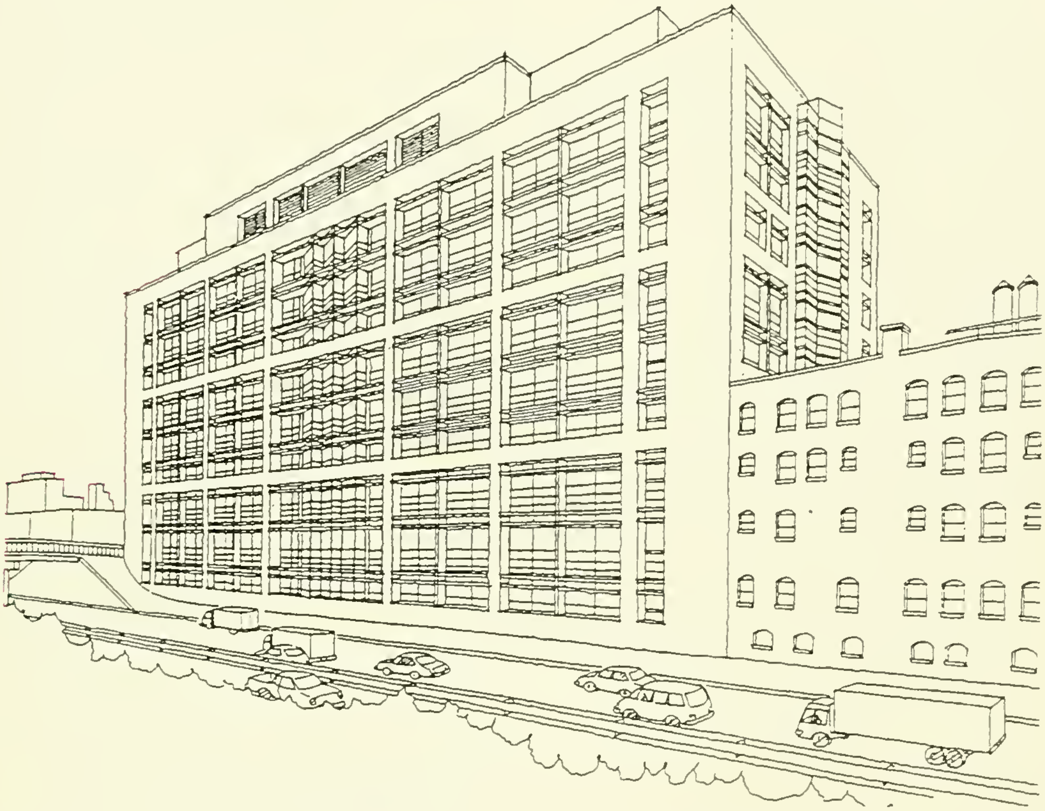
BOSTON UNIVERSITY
CENTER FOR PHOTONICS RESEARCH

Draft Project Impact Report



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Submitted To:
Boston Redevelopment Authority

Proponent:
Trustees of Boston University

Prepared By:
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October 7, 1994

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1.0 PROJECT SUMMARY

1.0 PROJECT SUMMARY

1.1 PROJECT NAME

Boston University Center for Photonics Research
22 Babbitt Street
Boston, MA 02116

1.2 SUMMARY PROJECT DESCRIPTION

Boston University (the University) proposes to construct a new $75 million Center for Photonics Research (the Project) on the Charles River Campus at 22 Babbitt Street on an approximately 46,205 square foot site (see Figure 1-1). The Project includes development of a new building, approximately 230,500 square feet of gross floor area, which will replace and upgrade science and engineering academic space and establish new photonics research facilities. The new building will include laboratory facilities, classrooms, a lecture hall and seminar space, and supporting photonics library facilities. The Project also includes modest renovations of existing academic facilities on the site which will include interior connections to the new building and combined mechanical and electrical service. The site currently contains a vacant building and science and engineering school facilities.

Summary of Benefits

The Project will provide a number of benefits which include but are not limited to:

- Creating approximately 109 permanent research and related administration jobs, and up to 250 construction jobs over a two year period.
- Providing state-of-the art facilities for research and new product development using photonics technology.
- Providing "incubator" space for new companies, including small, minority and women owned businesses.
- Expediting the creation of "spin off" businesses and associated new jobs in the region.
- Assist the region in capturing a large share of the rapidly growing $75 billion photonics products market.
- Upgrading existing University science and engineering laboratories and classroom facilities.
- Creating an innovative facility which integrates education with practical product development.
- Providing approximately $783,000 to the City of Boston: $652,500 to the Neighborhood Housing Trust and $130,500 to the Neighborhood Jobs Trust.

- Revitalizing the area with an attractive new building, landscaping, improved pedestrian circulation, and a reconstructed Babbitt Street.

The Center for Photonics Research involves three phases. Phase 1 involves the demolition of existing buildings at 8 St. Mary's St., 12 Babbitt Street, and 18-22 Babbitt Street.
Phase 2 of the Project involves the construction of a nine story building which will house classroom facilities, engineering laboratories, photonics laboratories, and supporting office and seminar facilities. Phase 3 involves modest renovations to the 47,600 square feet of existing academic space at 110-112 Cummington Street including connections to the new building. The Project concept is shown in Figure 1-2.

The Project construction is expected to begin in January of 1995 and be completed by the end of 1996.

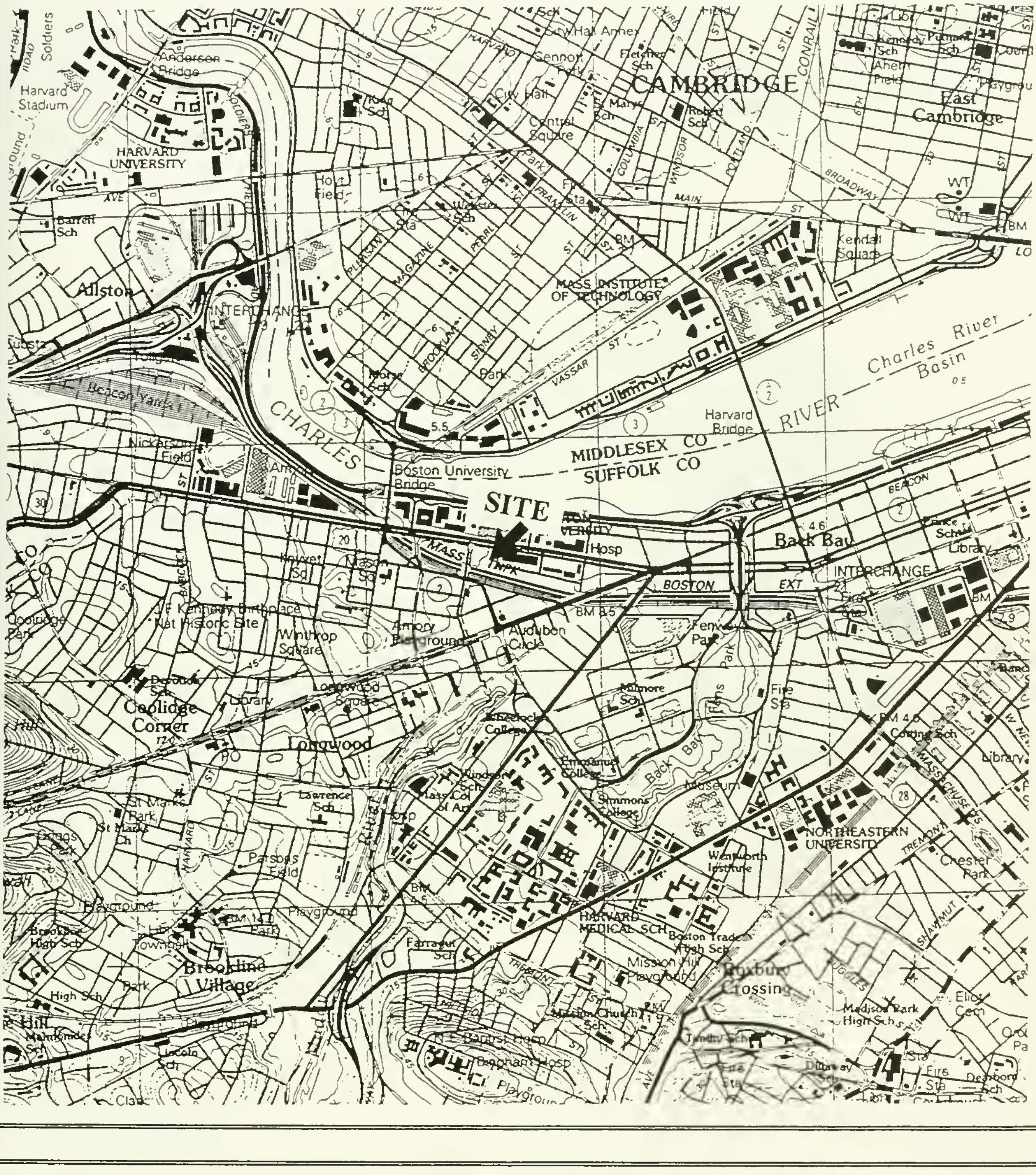
Background of Project

Photonics research is the practical use of light for a broad range of applications including high speed computation, communications, environmental sensing and controls, information storage, and biological and medical technologies such as a new generation of optical microscopes. Current photonics applications include telecommunications, surgery, compact disk technology, and supermarket checkout scanners. Photonics today is comparable to electronics in the 1950's. It is emerging as one of the most important technologies of the future.

It is the goal of the University to establish a world renowned photonics center which will emphasize development and marketing of new products using photonics technology. The photonics industry already accounts for $75 billion per year in revenues and is expected to triple during the next decade. It is hoped that these new photonics facilities will make Boston a market center for photonics activity, creating a new employment base for the City economy.

The University was recently awarded a $29 million grant from the Department of Defense to establish an interdisciplinary photonics research center on the Charles River Campus. The grant has two major requirements: to design and construct a new facility to house the Center for Photonics Research; and to establish on-going research and development and educational activities which will be housed in the new facility. The University is matching $16 million of the grant which is dedicated to design and construction. The Center for Photonics Research building will house three separate programs: Photonics Materials; Photonics Devices and Systems; and Photonics Communications, Management, and Training. The grant requires implementation within a three year time frame. In order not to jeopardize this grant, the Project must be expedited in a timely fashion.

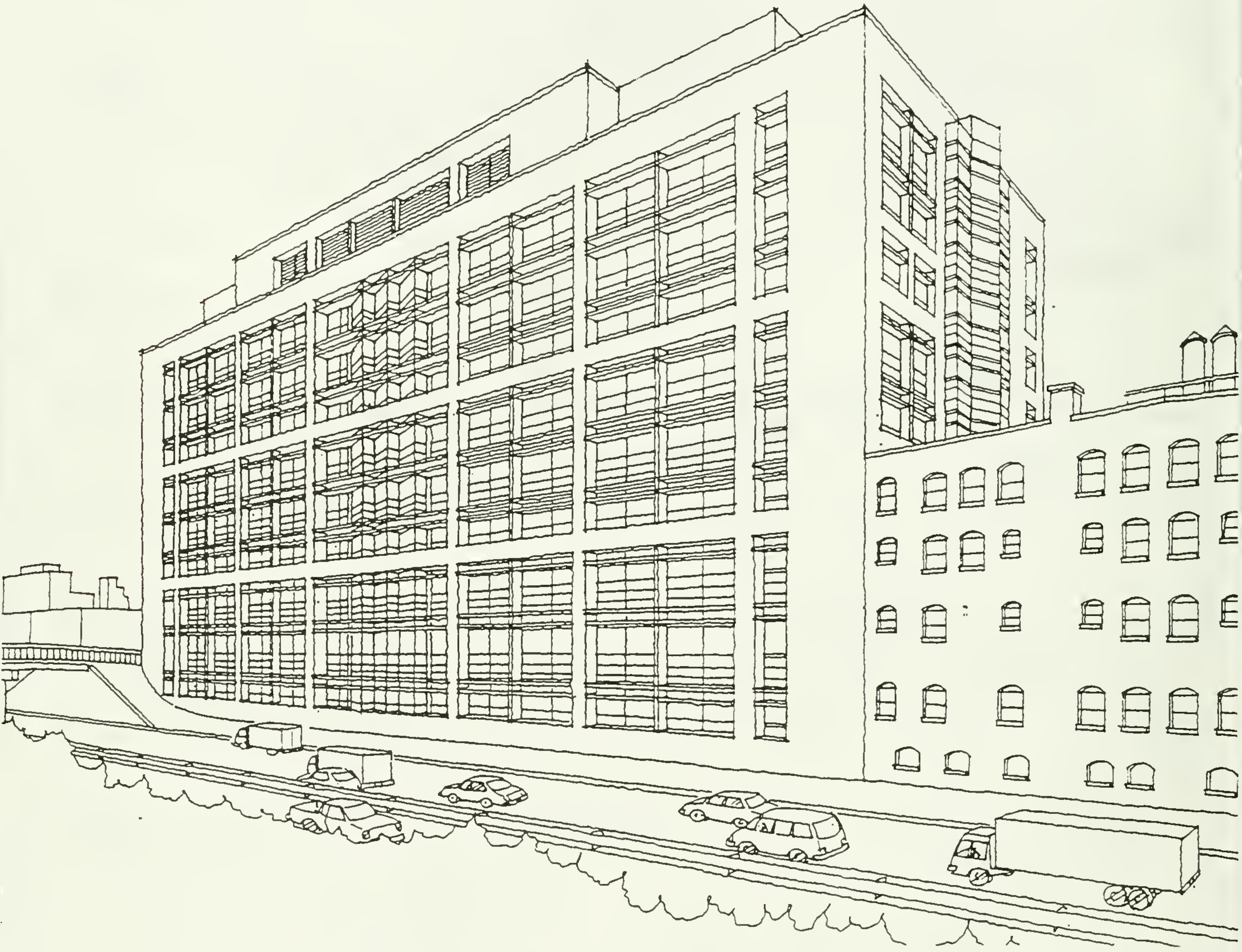
As part of the Project's building program, the University is taking the opportunity to upgrade and incorporate academic science and engineering space with the Photonics facilities because the uses are complimentary to each other and can serve multiple functions. The Project, therefore, will integrate practical science and engineering education on campus with local industrial research and



Locus Plan

Prepared By:
Fort Point Associates

Figure 1-1



Project Concept

Prepared By:
Cannon

Figure 1-2

development. The new building includes "incubator" space for new companies, including small, minority and women owned businesses as part of the academic facilities. The Center for Photonics Research is planned to be a perpetual resource for businesses and other organizations who otherwise would not have access to a complete array of synthetic, analytical, and fabrication equipment necessary for the development of practical devices and products.

1.3 PROJECT TEAM

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1.4 CURRENT OR FORMERLY OWNED DEVELOPMENTS IN BOSTON

The University is comprised of two main campuses in the City of Boston: the Charles River Campus concentrated along Commonwealth Avenue from the Kenmore Square area to the eastern edges of Allston around Nickerson (formerly Braves) Field; and the Medical Campus concentrated in the South End between City Hospital and University Hospital. Master plans for each of the two campuses have been approved by the Boston Redevelopment Authority (BRA). Developments in accordance with the master plans are continually ongoing on both campuses. See the figure on the following page for University ownership within the Charles River Campus.

1.5 LEGAL ACTIONS PENDING

The University is not aware of any legal actions pending or threatened with regard to this project.

1.6 TAX ARREARS

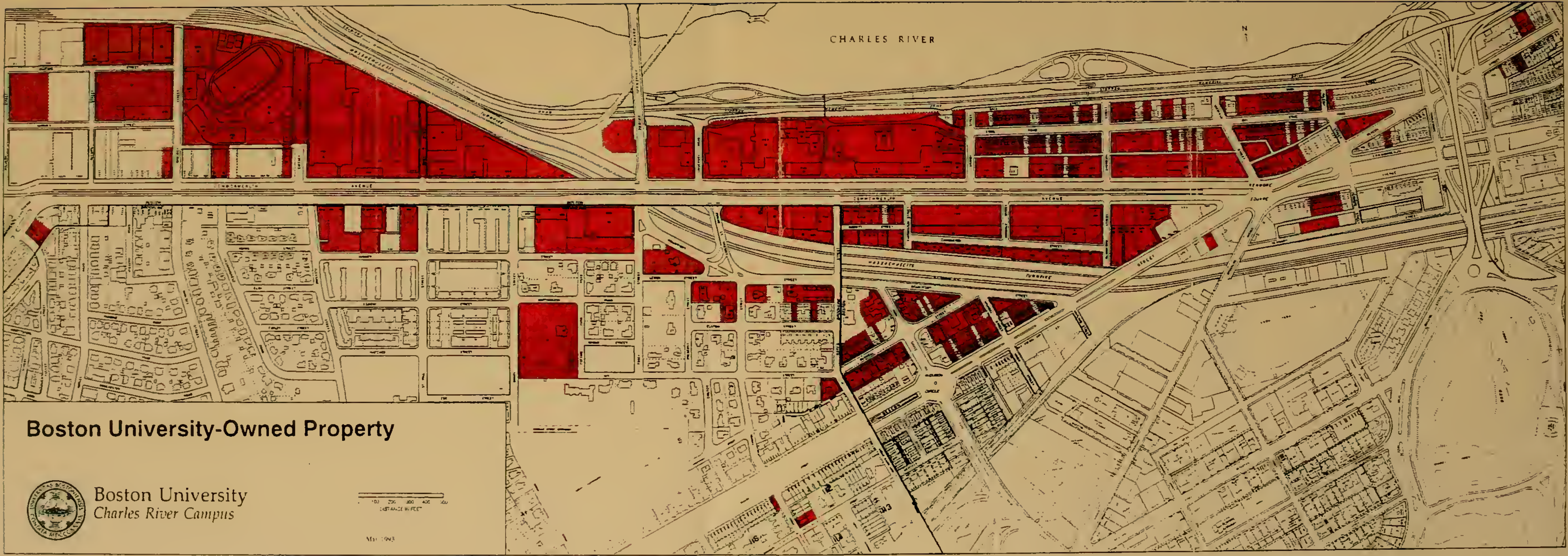
All taxes due have been paid to date.

1.7 EVIDENCE OF SITE CONTROL

The Project site was acquired by the University as three separate parcels. The easterly portion of the site (108-112 Cummington Street a.k.a. 104-110 Cummington Street) was acquired in 1962. The middle portion of the site (12-18-22 Babbitt Street) was acquired in 1971. The westerly portion of the site (6-8 St. Mary's Street) was acquired in 1992. The University holds fee simple title to the entire site.

1.8 AGENCY AND COMMUNITY REVIEW PROCESS

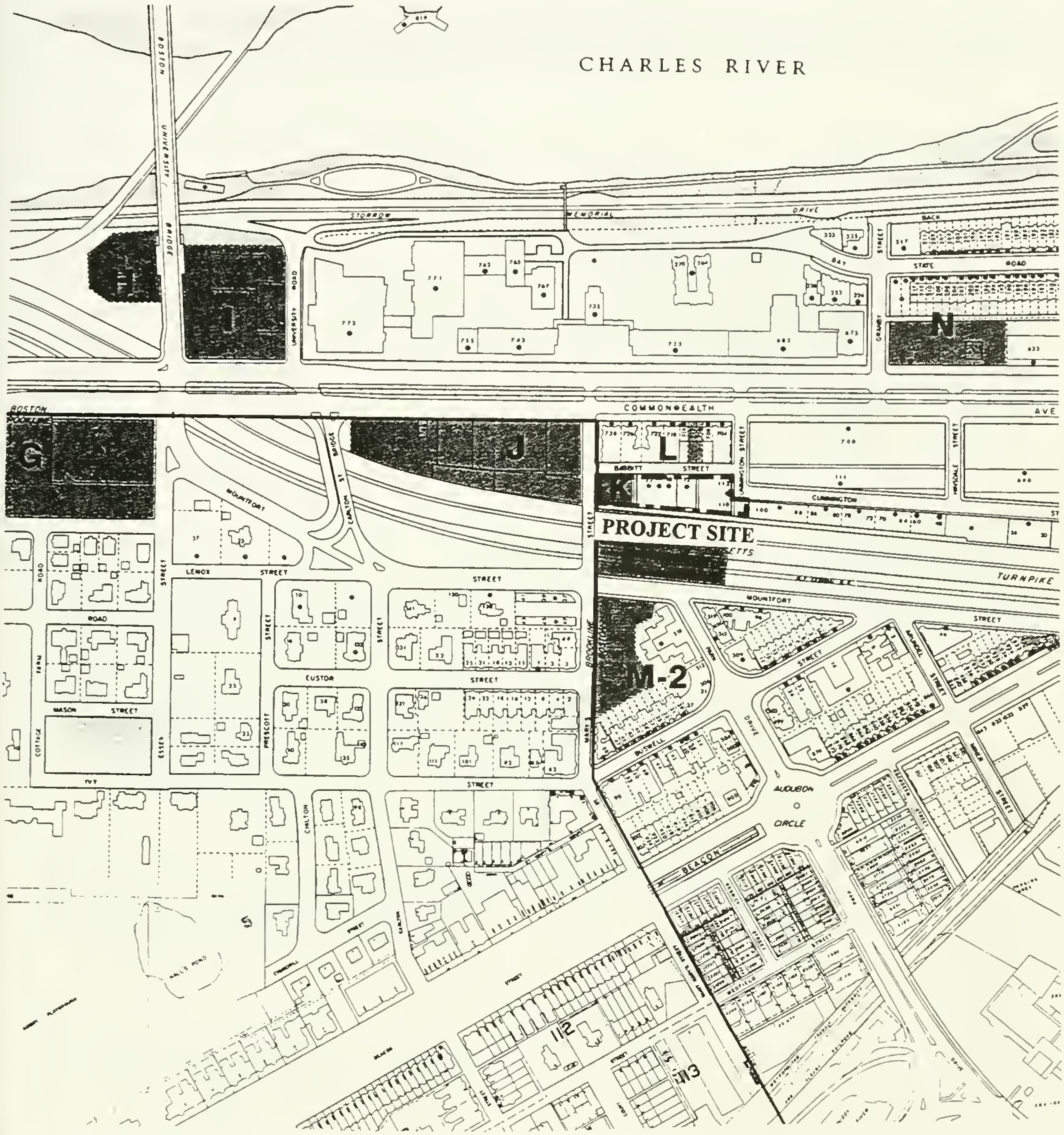
The Project is consistent with the Boston University Charles River Campus Master Plan 1986 - 1996 (the Master Plan). The Master Plan is the result of the comprehensive planning process which included City officials, numerous community and special interest groups, and University officials. As a result, the Master Plan enjoys endorsement of a broad range of groups and individuals. The Master Plan was submitted and approved by the City in early 1987. The Project site is located on Parcel K as presented in the Master Plan and also on the adjacent engineering school buildings at 12-22 Babbitt Street and 110-112 Cummington Street (see Figure 1-3). The Master Plan proposes the site as a logical extension of the engineering complex. Parcel K has been acquired and chosen for this Project, which is indeed an integration and extension of the science and engineering complex on campus. The Master Plan will be updated to reflect the Project use as proposed. The University has made two presentations to the Boston University Task Force on the Project. One meeting was held on April 12, 1994 and the other on May 11,



Boston University-Owned Property

Boston University
Charles River Campus

May 1993



Potential Site Plan - Parcel K and Project Site
(Boston University Charles River Campus Master Plan 1986-1996)

Prepared By:
Fort Point Associates

Figure 1-3

1994. At the latter meeting, the Task Force voted to approve the Project concept and to recommend the amendment of the Master Plan to reflect the Project. A Current list of the task force includes:

Allston Board of Trade
Allston Civic Association
Allston-Brighton Area Planning Action Council
Allston-Brighton Community Development Corporation
Audubon Circle Neighborhood Association
Bay State Road Civic Association
Bay State Road Neighborhood Association
Boston University Student Union
Brighton Board of Trade
Brighton-Allston Improvement Association
Cottage Farm Neighborhood Association
Fenway Community Development Corporation
Jackson-Mann Community School Council
Kenmore Association
Kenmore Community & Economic Development Corp.
Kenmore Residents' Group
North Brookline Neighborhood Association
Society for the Preservation of Audubon Circle

A Project Notification Form (PNF) was submitted to the Boston Redevelopment Authority (BRA) on May 17, 1994. A Determination was issued on June 22, 1994. The Determination is included in Section 1.12. The Project was presented to the Boston Civic Design Commission (BCDC) on September 6, 1994 and is in the process of undergoing detailed review the BCDC Design Subcommittee.

Discussions with the Massachusetts Water Resources Authority (MWRA) regarding an update campus discharge permit are on-going. The MWRA will issue a campus-wide permit which will include the Project. A meeting was held with the Boston Water and Sewer Commission (BWSC) on September 9, 1994 to review the Project design and schedule. Contacts with agencies are documented in Appendix E.

An Environmental Notification Form (ENF) was filed with the Massachusetts Executive Office of Environmental Affairs MEPA Unit on May 15, 1994. A notice was published in the Environmental Monitor on May 24, 1994, and a MEPA consultation session was held on June 2, 1994. A Certificate on the ENF was issued on June 23, 1994 stating that no environmental impact report was required for the Project. A Notice of Project Change (NPC) was filed with MEPA September 15, 1994 identifying the need for state fossil fuel utilization permits. A Certificate is expected by the end of October, 1994.

The Project must also comply with the National Environmental Protection Act (NEPA) due to the involvement of federal funds. In accordance with NEPA, an Environmental Assessment was filed with the Department of Defense on June 14, 1994.

1.9 COMMUNITY SERVICES AND BENEFITS

For over a century, Boston University has been an integral part of the City of Boston. Committed to an urban campus, it has consistently grown and contributed to the character and identity of the City of Boston and served as a prominent economic stabilizing force. The University's national and international prestige significantly strengthens the City of Boston's national and international reputation. For example, in 1989, both Presidents Bush and Mitterand spoke at Boston University's commencement. In addition to being a significant employer in the City of Boston, the University contributes directly to the economic well-being of the City of Boston and provides direct services to local community residents and businesses.

Economic and Employment Benefits

Benefits from Boston University which contribute to the Boston economy include employment, property taxes, federal grants, and through the acquisition of goods and services by the student, faculty and the administrative population. In fiscal year 1992, the University and its affiliates and students expended over $710 million. Of this amount, $558.8 million was spent in direct expenditures within the Commonwealth of Massachusetts. In addition, an estimated $641.2 million in indirect expenditures was generated (based on economic multiplier factors established by the U.S. Department of Commerce, Bureau of Economic Analysis), resulting in a total impact of $1.2 billion in 1992 alone.

In 1992, Boston University directly employed over 21,500 people and indirectly created approximately 11,500 jobs, providing a total employment impact of close to 33,000 jobs. It was estimated that students alone brought in an additional $129.7 million related to living expenses. The total direct and indirect economic impact from the University in 1992 was estimated to be $396.2 million in the City of Boston.

In the 1992 fiscal year, Boston University employed approximately 2,900 Boston residents who earned more than $58 million in salaries and wages. They used more than 4,500 city vendors of goods and services with direct expenditures of more than $70 million. Student expenditures in the City of Boston totaled over $74 million.

Tax Status

Boston University makes direct payments to the City of Boston in the form of taxes, in-lieu-of-tax payments, fees and permits. In fiscal year 1992, the University paid the City of Boston over $2.8 million. This reflects $1.9 million in real estate taxes, $331,000 in-lieu-of-tax payments, and $577,000 in fees and permits.

Under the 1980 Cooperation Agreement with the City of Boston, notwithstanding its tax-exempt status, the University voluntarily pays real estate taxes on any taxable properties acquired after 1980 within the boundaries defined in this document. Accordingly, the University continues to pay property taxes on the Project site which are estimated to be $22,278 in the FY 1994.

Municipal Services

As a major urban institution in the City of Boston, Boston University takes the responsibility of providing and augmenting major municipal services in and around its campus. It employs its own police and security forces 365 days a year, 24 hours per day to patrol the campus and surrounding neighborhoods. University police forces are also available for on-call back-up assistance to Boston Police, Brookline Police and State Police as necessary. They also assist the City of Boston in the issuance of parking tickets, which raised approximately $50,000 in 1992.

The Boston University Physical Plant provides a variety of daily maintenance activities around campus. These responsibilities include maintenance of sidewalks, streets, and MBTA tracks serving the campus. They also provide and maintain landscaping and perform rubbish and snow removal services. In 1992, these services were provided at a cost of over $600,000. Rubbish removal services are provided for private rental housing properties in addition to properties owned and occupied by the University.

Scholarship Programs

The University annually provides hundreds of scholarships to residents of the Greater Boston community. The Boston Scholarship Program awards 58 full, four year scholarships to Boston High School graduates every year. This program, which is 20 years old, is the largest program of its kind in the United States. In 1992, over 350 scholarships worth close to $5 million were awarded to Boston public high school graduates, Boston city employees, Boston public school teachers, Boston parochial school graduates, graduates of Bunker Hill and Roxbury Community Colleges, and families of fire fighters killed in the line of duty. Over the past ten years, almost $1 million in aid has been designated for City of Boston employees. The cumulative value of such scholarships since 1981 is over $33 million. In addition, the University provides scholarships to residents of Chelsea and Brookline.

Boston University cultivates a significant amount of federal research dollars, student loans, and donations from outside the state. In the 1991-1992 academic year, the University brought approximately $220 million to Boston in tuition and fees from outside the state. It also won $60 million in federal research funding and brought in $37.2 million in donations, $31.5 million of which were from outside the state. Student loan activity associated with Boston University totaled almost $35 million in the 1991-1992 academic year.

Other Community Services

Boston University provides numerous educational, training, health, legal and cultural programs which are directly and indirectly funded by the University. Boston University also allows tuition reduction for City of Boston employees. The following is a list of program categories. A summary description of each program may be found in Appendix A, Boston University Community Programs.

Services to Educational Institutions

Centers, Institutes, and Partnerships
Student Teacher Field Placements
Early Childhood and Middle School Programs
Secondary School Programs
Programs for Teachers and Administrators

Services to Other Non-Profit Institutions

Staff Training
Professional/Technical Assistance
Volunteer Staffing
Funding and In-Kind Donations

Services to Individuals and the Community at Large

Scholarship Assistance
Government and Community Affairs
Health Care Services
Dental Care Services
Athletics/Fitness
Adult Education Programs
Programs for Professionals
Programs for the Elderly
Programs for People with Disabilities
Mentoring and Counseling
Religious Education and Ministry
Legal Assistance
Charities/Community Action
Cultural and Intellectual Programs

Project Benefits

The Center for Photonics Research project is subject to Article 26A and 26B of the Boston Zoning Code which established linkage obligations for developers to off-set impacts of large scale development. Article 26A requires a payment toward low and moderate housing through the direct creation of housing or contribution to the Neighborhood Housing Trust. Similarly, Article 26B requires a contribution to the Neighborhood Housing Trust for training of low and moderate income people, or creation of such jobs directly by the development. For the Project, the new building will generate approximately $783,000 including $652,500 to the Neighborhood Housing Trust and $130,500 to the Neighborhood Jobs Trust. The Project is expected to generate approximately 109 new jobs in research and supporting administrative jobs and an additional estimated 250 construction jobs over a two year period.

The Center for Photonics Research will serve as a catalyst in stimulating a new market for the development of photonics products in Boston by providing state-of-the-art facilities for research and development. The photonics industry already accounts for $75 billion per year in revenues which is expected to triple over the next decade. It is hoped that the facilities developed by the University will set the stage to make Boston a center for photonics research activity. These facilities can also provide "incubator" space for new companies, including small and minority businesses.

The Research Center will create unique facilities which pioneer the integration of practical and academic research activities. The programs will provide engineering students the opportunity to participate in commercial product development.

1.10 SUMMARY OF ENVIRONMENTAL ISSUES AND MITIGATION MEASURES

This Draft Project Impact Report has been prepared in accordance with the June 22, 1994 Scoping Determination issued by the Boston Redevelopment Authority (BRA) on the Project Notification Form submitted on the Boston University Center fro Photonics Research project. The following is a summary of environmental topics and findings addressed in this report.

Chapter 4.0, Wind

Impact

A qualitative assessment of the pedestrian level wind environment for No-Build and Build conditions was conducted for the Project. In a few locations, the No-Build wind conditions are borderline uncomfortable or unacceptable. The addition of the Center for Photonics Research will increase wind activity in several locations. The Build conditions will generally increase wind conditions along Babbitt Street and portions of St. Mary's Street as well. Other locations reviewed will experience Build conditions similar to No-Build conditions.

Mitigation

The Project provides internal connections the entire length of Babbitt Street from the 110-112 Cummington Street entrance to St. Mary's Street. This alternate route offers protection to local pedestrians from all uncomfortable weather conditions. Various types of other wind mitigation measures will be developed and tested for effectiveness in a quantitative analyses. The results will be presented in the Final Project Impact Report.

Chapter 5.0, Shadow

Impact

A shadow study was conducted to identify net new shadows resulting from the Project on public streets, walkways, and public open spaces. The analysis examined conditions during the vernal equinox, summer solstice, autumnal equinox, and the winter solstice at 9:00 A.M., noon, and 3:00 P.M. The net new shadow resulting from the Project are minimal due to shadows created by existing buildings backing onto Babbitt Street and other neighboring buildings. The new shadows will be evident on Babbitt Street and on portions of St. Mary's Street. For the study conditions, net new shadows created by the Project do not significantly impact sensitive public areas and do not impact any historic districts.

Mitigation

Because the net new shadows created by the Project are so minimal, no additional mitigation measures are contemplated.

Chapter 6.0, Daylight

Impact

A daylight analysis of the Project was conducted using the Boston Redevelopment Authority Daylight Analysis (BRADA) model. The analysis evaluated daylight obstructed by the Project from three pedestrian view points -- Babbitt Street, St. Mary's Street, and the Massachusetts Turnpike. An analysis was also conducted from the same viewpoints for a hypothetical building reflecting the current M-2 zoning FAR of 2.0. A two story building covering the lot was selected to reflect the 2.0 FAR as is approximates what currently exists on the site. For comparison purposes, an additional analysis was conducted for a similar existing building near the Project site at 44 Cummington Street. This analysis included the Massachusetts Turnpike and Cummington Street viewpoints.

The results revealed daylight obstruction values for the Project and the comparison building at 44 Cummington Street were similar with values of 65.9 and 62.6 respectively from the Massachusetts Turnpike. They were also similar from St. Mary's Street and Cummington Street with a value of 86.2 for the Project and 83.9 for 44 Cummington Street. Being a narrow alley, the daylight value for the Project from Babbitt Street is high at 92.0. Analysis of the hypothetical building with a FAR of two resulted in daylight values of 20.9 from the Turnpike, 62.7 from Babbitt Street, and 56.1 from St. Mary's Street.

Mitigation

The daylight values for the Project are in keeping with the character of other newer buildings on the science and engineering complex such as the 44 Cummington Street building. No further mitigation is contemplated.

Chapter 7.0, Air Quality

Impact

Air quality issues of concern are associated with research activities conducted within the Research Center and exhausts from mechanical systems as they may impact students, employees, and nearby residents. Laboratory facilities proposed for the Research Center have very high ventilation demands. Accordingly, the Project contains a high capacity exhaust system. The laboratories contain a manifolded exhaust system which assists in the dilution of any airborne chemicals prior to exhausting from the building. Air intakes and exhausts are strategically located away from each other and from potential conflicting intake or exhaust vents. Exhaust vents are also located in the mechanical penthouse over 160 feet above average grade away from residences on Babbitt Street. The boiler system for the Project is located in the mechanical penthouse. It is a dual fired system using natural gas and #2 fuel oil.

Mitigation

The laboratory facilities are designed in accordance with the American National Safety Institute standards to assure operating safety. The design for ventilation and exhaust of mechanical systems includes operating features and controls which insure safety of the building occupants and of nearby residents. The boiler system designed for the building will meet will meet the DEP Best Available Technology Control criteria. The system will backfeed the 110-112 Cummington Street building allowing removal of the old oil burning heating system. All exhausts will be discharged vertically through the penthouse roof.

Chapter 8.0, Water Quality

Impact

The majority of laboratories in the Center for Photonics Research are designed as "dry" laboratories for activities such as electronic and computer research. Dry laboratories do not require unusual water demands. A portion of the laboratories are designed for "wet" uses associated with chemistry and biomedical research activities that often generate water wastes which require special treatment. The laboratory facilities in the Research Center are similar to other laboratory facilities on the Boston University campus. They will be subject to the Boston University Safety Office procedures, MWRA, and OSHA requirements.

Mitigation

The Research Center water waste will meet all applicable local, state, and federal regulations for handling and disposal. No wastes will enter the municipal system that do not strictly conform with MWRA and BWSC standards. The Research Center sanitary sewer system will be constructed of acid-resistant materials. The system is equipped with interceptors for silver recovery and procedures for mercury capture will be followed. All laboratory waste systems will also be equipped with automated acid neutralizing equipment including a pH analyzer with a recorder and alarm, mixing tank, caustic tank with a meter feed pump, neutralizing tank and effluent monitor.

The Safety Office has drafted chemical safety guidelines which provides a program for handling, monitoring, storage, and disposal of chemicals associated with activities in the Research Center. The draft guidelines are found in Appendix C.

Chapter 9.0, Solid and Hazardous Wastes

Impact

Construction

The Project requires excavation of approximately 6,000 - 10,000 cubic yards of soil associated with construction of the foundation and basement. The preliminary site evaluation indicates the presence of two oil tanks and the presence of low levels of petroleum constituents in the soil. These levels were below those that would require notification of DEP. Very low levels of tetrachloroethene were found in a groundwater sample from one of the existing monitoring wells on site.

Site preparation will involve the demolition of three buildings. These activities will include the removal of the two oil tanks and asbestos material on interior pipes in addition to the bricks, structural, steel, and concrete typically associated with demolition activities.

Operations

A trash compactor will be housed in the loading area to handle standard trash. The compactor will be serviced along with the rest of the campus wastes. Recycling centers will be located on each floor to receive paper, cans, bottle, plastic and other materials like styrofoam cups. Special waste receptacles will be placed at each laboratory work station for any wastes which require special handling. The Boston University Safety Office personnel will be responsible for pick-up of these materials as part of the University special waste management program. Licensed haulers who currently remove special wastes from campus will also handle wastes associated with the Research Center.

Mitigation

Construction

The site is currently undergoing additional soil and groundwater testing to detect the presence of contaminants. Eight new borings have been installed across the site. A monitoring well will be installed in the boring nearest to St. Mary's Street in addition to the three existing wells on site. The results of these tests will be presented in the Final Project Impact Report. A Soil Management Plan will be developed in advance of construction to assure conformance with the Massachusetts Contingency Plan. A suitable groundwater monitoring and treatment plan will be established prior to construction for construction dewatering activities. Asbestos will be removed by a licensed contractor prior to demolition. A comprehensive handling and disposal plan will be developed and approved by the City prior to construction.

Operations

The Boston University Safety Office has drafted safety guidelines which outlines a program for handling, monitoring, storage, and disposal of hazardous materials associated with research activities. (The draft guidelines are found in Appendix C.) All wastes associated with the operations of the Research Center will be handled as part of the campus-wide handling and disposal programs.

Chapter 10.0, Noise and Vibration

Impact

Construction

Noise and vibration impacts during construction are largely associated with demolition activities, driving of soldier piles or sheet piles. If a pile-supported foundation is selected for the Research Center then pile driving will be required.

Operations

The Research Center will necessarily contain exterior mechanical equipment required for the building operations. The majority of mechanical equipment for the Research Center is located in the mechanical penthouse over 160 feet above average grade and approximately 100 feet above neighboring residential buildings. The penthouse will contain three cooling towers, refrigeration chillers, boilers, HVAC air handling units, and an emergency power generator among other equipment.

The Research Center will contain vibration sensitive equipment in some of the laboratories. The building foundation system is designed to isolate these laboratories from external vibration while optical laboratories will also be fitted with isolation optical benches.

Mitigation

Construction

All construction work will be performed in accordance with the Regulations for the Control of Noise in the City of Boston. A Construction Management Plan will be developed which stipulates protocols for the control of noise such as defined construction hours, truck routes, periodic muffler inspection, and vibration monitoring procedures. Where warranted, piles will be pre-augured to minimize impacts.

Operations

The cooling towers are located in the penthouse level located in the southeast corner away from residential buildings to the north. The air intake vents are located on the north side of the mechanical penthouse and will be fitted with noise attenuators to reduce potential exterior noise. Exhaust fans are located on the south side of the mechanical penthouse away from residences and will also be fitted with noise attenuators. The emergency generator is located in the northeast corner of the penthouse. The system will be vertically vented up through the penthouse roof. The required tests will be performed during normal working hours to minimize impacts on adjacent areas and will be operational only for short periods of time or for emergency use.

Chapter 11.0, Geotechnical Impacts

Impact

Preliminary analyses of geotechnical conditions indicate consideration of both mat and pile foundation. The foundation does not involve extensive subsurface excavation but will extend between 10 to 33 feet below grade varying with the existing grade of the site. Excavation support will consist of soldier piles or sheet lagging. Lateral support will be provided by temporary tiebacks and/or internal diagonal braces along the west, north, and east sides of the site. Cantilever support is likely to be adequate along the south side. Localized temporary dewatering will likely be required at the west end of the site during construction. This is not expected to have any impact on adjacent structures. After construction, the groundwater level will return to its original elevation quickly.

Mitigation

Based on anticipated excavation levels, none of the adjacent facilities will be significantly impacted. Special consideration has been given to protection of adjacent utilities in St. Mary's and Babbitt Streets, the 110-112 Cummington Street building, the St. Mary's Street Bridge, the Turnpike property, and other nearby structures.

Chapter 12.0, Transportation

Impact

The development of the Research Center will generate a minimal number of new trips and is forecast to have negligible impacts on the transportation system in the area. The Project will not result in increased student enrollment and will have fewer than 100 new employees in the Research Center. The Research Center will include replacement of existing academic facilities as well as providing new research facilities. The majority of the Research Center activity is already being conducted on campus, mostly located in the adjacent science and engineering complex. Since the majority of new research activities will employ existing students, few occupants of the building will be new to campus. Based on expected occupancy of classrooms, laboratories, and office, approximately 282 new daily trips will be generated by the Project. Based on travel mode split research at Boston University, approximately 220 of these trips will be made by automobile. These trips will be distributed among several approach corridors to campus and are not anticipated to significantly affect any given intersection.

There is no on-site parking included in the Center for Photonics Research project. It is estimated that the Project will create a new parking demand of approximately 73 spaces. The demand can be accommodated in the 3,000 parking spaces currently provided on the Boston University Charles River campus. Of these, almost 900 University controlled spaces are contained in lots near the Project.

Construction will occur largely between 7:00 A.M. and 3:30 P.M. on weekdays. It is anticipated that the peak number of construction workers on site will not exceed 150. Street closures will be minimal if at all. Truck routes and volumes will be determined in the Construction Traffic Management Plan to be submitted and approved by the City.

Mitigation

The University implements a number of campus-wide mitigation measures which will apply to this Project.

- The Project travel demand will be incorporated into all the University's travel demand management programs.
- Ridesharing, public transportation, and on-campus transit service information are readily available on campus.
- MBTA passes and information are available at the George Sherman Student Union which is centrally located on campus.
- Indoor bicycle storage will be provided on the first floor of the Research Center in addition to the existing bicycle facilities on the open space on the Project site.

- New signs for pedestrians will be provided directing them to public transportation facilities, and to key locations and facilities on campus.
- Construction traffic measures will include:
  - subsidy of MBTA passes for construction workers
  - parking and staging at the Boston University Armory site
  - designated truck routes restricting trucks from residential areas
  - police officer traffic control as needed
  - maintaining access along Babbitt Street during construction or provision of a reasonable alternative

Chapter 13.0, Historical Resources

Impact

Research was conducted to identify historical and archeological resources on and near the Project site. Research findings revealed that the site contains no known historical or archeological resources. Further, the Project site is not within, nor does it directly abut any historical districts. Historic resources in the vicinity of the Project site include the Bay State Road/Back Bay West Architectural Conservation District, Charles River Basin District, and the Cottage Farm Historic District in Brookline.

Mitigation

The Project does not create any significant impacts on these historic resources. The shadow study reveals that even the winter study scenarios do not reach nearby historic districts.

Chapter 14.0, Infrastructure

Impact

The Project site is currently served by public and private utilities. No known problems have been identified by utility owners in providing service to the proposed Project. The Project includes a new boiler system which will backfeed the 110-112 Cummington Street building and replace the existing oil burning system. Electrical and telecommunication service to the 110-112 Cummington Street building will be upgraded and/or replaced as part of the Project.

BWSC has been contacted regarding the Project and will continue to review the Project through their permitting process. Discussions with MWRA regarding discharge requirements for the campus are in progress. The Project will be included in the resulting permit.

Water

The peak water demand for the Project is estimated to be 338 GPM including domestic and air conditioning make-up requirements. The domestic water service will be supplied by a 6-inch pipe brought in from a new 10-inch water main in Babbitt Street.

Fire Protection

The water demand for fire protection water is estimated to be 1,000 GPM. A separate 8-inch connection will be brought in from the 10-inch water main in Babbitt Street for fire protection. Hydrant flow tests conducted at hydrants 24 and 28 indicate adequate pressure to service the Project.

Sanitary Sewer

The building is estimated to produce approximately 10,910 GPD based on DEP guidelines (314 CMR 7.00). Service connections will be made at two locations with 8-inch PVC pipe connections from the 10-inch sanitary sewer line in Babbitt Street.

Storm Drainage

The overall impervious surface on the Project site will not be increased as a result of the Project. Therefore, no net increase in stormwater runoff is anticipated. The entire roof area from the Research Center will be directed into the current 15-inch storm drain in Babbitt Street thereby increasing the runoff into that system. The 15-inch storm drain will be replaced with an 18-inch storm drain.

Other Utilities

Other utilities including electrical service, telecommunications, and gas will be supplied by private utility companies. These services will include the 110-112 Cummington Street building in addition to the Research Center.

Mitigation

Water

As part of the Project, the existing 8-inch water main in Babbitt Street will be replaced with a new 10-inch main running the length of Babbitt Street. This will complete the 10-inch loop between St. Mary's and Cummington Streets enhancing water flow characteristics in the area.

Water conservation measures are incorporated into the building design through a number of measures including: low flow plumbing fixtures; infrared automatic sensor faucets in public toilets; high efficiency drift eliminators in the cooling towers; condensate resulting from the boiler system will be collected and recycled to the boiler feed system. The site does not allow enough landscaping to warrant an irrigation system.

Fire Protection

Although hydrant pressure is considered adequate, a fire pump to boost the water pressure will be provided to service the Research Center.

Sanitary Sewer

The existing 10-inch sewer line in Babbitt Street will be extended along Babbitt Street to facilitate the westerly connection. There is ample capacity to service the Project.

Storm Drain

The new 18-inch storm drain installed in Babbitt Street will result in a net increase in the operating capacity of the system. The existing 10-inch sanitary sewer line and 15-inch storm drain in Babbitt Street connect jointly into a manhole. As a part of the Project, these will be separated so sanitary sewage and stormwater will be discharged into separate systems. Further, stormwater catch basins will be equipped with sumps and oil separators.

Other Utilities

The Boston Gas Co., Boston Edison, and NYNEX have all been contacted regarding service to the Project. No known problems or constraints have been identified.

Chapter 15.0, Construction

Impact

Construction impacts associated with the Project are not expected to be unusual. The Project includes demolition of approximately 22,200 cubic yards of brick, concrete, and structural steel debris. Any asbestos in these buildings will be removed prior to demolition by a licensed contractor. Construction activities are expected to take place over a 22 month period starting in early 1995 through the end of 1996. The Project will have a peak daily work force between 100 - 150 workers. Work hours will typically be between 7:00 A.M. and 3:30 P.M.

Subsurface excavation associated with the foundation is estimated to involve approximately 6,000 - 10,000 cubic yards of soil depending on the selected foundation system. Temporary dewatering will be required inside the limits of excavation. The excavation support system will consist of soldier piles and lagging or sheet piles. All necessary measures will be taken to protect adjacent utilities and structures, including the 110-112 Cummington Street building.

Mitigation

Construction worker parking is planned to be at the Boston University Armory site. MBTA passes for construction workers will be subsidized to reduce worker parking demand. The site offers very limited opportunity for staging activities. It is anticipated that the Armory site will be used for staging of equipment and materials also.

Air quality impacts will be minimized through dust control by wetting agents and inspections of vehicles on-site. Noise impacts off-site are not expected to be significant as there will be no blasting during construction. If pile-driving is necessary, it will be conducted in accordance with City requirements. When dewatering is necessary, water will be monitored for its quality, and treated prior to discharge when warranted. Construction techniques will be employed to protect utilities from unnecessary disruption.

Precautions will be taken to protect public safety through clearly marked walkways, fencing, University security patrols, and police details as necessary. There will be coordination with other construction activities in the area as necessary. A Construction Management Plan will be prepared and implemented before construction. This Construction Management Plan will address:

- Staging for materials and machinery
- Traffic management plan and police coverage
- Designated truck routes and waiting areas
- Pedestrian safety and security
- Dust and air quality controls
- Dewatering monitoring and treatment procedures
- Foundation protection techniques
- Noise and vibration controls
- Handling of excavated materials
- Rodent control measures

1.11 REGULATORY CONTROLS AND PERMITS

Federal Approvals

The Center for Photonics Research is the result of a federal grant from the Department of Defense and therefore requires compliance with the National Environmental Protection Act (NEPA). In compliance with NEPA, an Environmental Assessment was filed on June 14, 1994.

State Approvals

Private projects requiring state permits may be subject to state environmental review under the Massachusetts Environmental Policy Act (MEPA). Projects which require state permits and/or exceed stipulated size or impact thresholds are required to file an Environmental Notification Form (ENF) and, in some cases, an Environmental Impact Report. An ENF was filed for the

Center for Photonics Research on May 15, 1994. A decision issued on June 23, 1994 stated that no environmental impact report is required for the project. A NPC was filed with MEPA September 15, 1994 to reflect the need for fossil fuel utilization permits. A Certificate is expected by the end of October, 1994. An Industrial User Permit from the Massachusetts Water Resources Authority is anticipated for the project. The Project will be included in a campus-wide permit which is in progress.

City of Boston Approvals

While the Boston Zoning Code does not require the preparation of a Project Notification Form or a Project Impact Report for the new Center for Photonics Research because the Project site is not within the boundaries of the Article 31 review area, the University recognizes the importance of the City of Boston goals and interests embodied in Article 31 and the important urban location of the Project. Furthermore, the BRA has already approved a Master Plan for the Boston University Charles River Campus. Therefore, the University is voluntarily submitting a Project Notification Form and Impact Report in connection with the Project. The University is in the process of amending the Master Plan to reflect the Center for Photonics Research Project more completely. Two meetings have been held with the Boston University Task Force to discuss the Project. One meeting was held April 12, 1994 and the other was held May 11, 1994 when the Task Force voted to approve the Project concept and to recommend amending the Master Plan accordingly.

The Project will require zoning changes and will pursue a Planned Development Area (PDA) designation for the site pursuant to Section 3-1A(a) of the City of Boston Zoning Code. The PDA procedure was identified as the preferred zoning mechanism in the approved Charles River Campus Master Plan. The PDA designation will permit the development of the site in accordance with a development plan approved by the BRA. The Project is located in a M-2, or light manufacturing zone. Accordingly, the PDA will seek exceptions from the Boston Board of Appeal for provisions regarding: use, to allow university and accessory uses; minimum rear yard depth; parapet setbacks; off-street loading; and signage. The Project will undergo BRA design review and Boston Civic Design Commission review.

Other approvals will be required from Boston Transportation Department and Boston Department of Public Works. The Project will also require Boston Water and Sewer Commission approvals for water and sewer connections and construction dewatering.

City of Brookline

The Project site directly abuts St. Mary's Street which is situated in Brookline. Construction activities will require coordination and related permits from the Brookline Public Works Department.

Anticipated approvals are summarized in the chart following this page.

FEDERAL AGENCY	***APPROVAL***
Department of Defense	NEPA Compliance

STATE AGENCY	***APPROVAL***
Executive Office of Environmental Affairs	MEPA Approval
Massachusetts Water Resources Authority	Industrial Use Discharge Permit
Massachusetts Historical Commission	Finding of No Adverse Effect
Massachusetts Department of Environmental Protection	Fossil Fuel Utilization Permit

MUNICIPAL AGENCY	***APPROVAL***
Boston Redevelopment Authority	Approval of PDA/DIP Design Review Approval Zoning Recommendations
Boston Employment Commission	Construction Employment Plan
Boston Zoning Commission	Planned Development Area Designation
Boston Board of Appeal	Zoning Exceptions
Boston Fire Department	Fire Apparatus Access Approval Permit for Maintenance of Fire Protection Equipment
Boston Inspectional Services Department	Demolition Permit Building Permit Certificate of Occupancy
Boston Water and Sewer Commission	Sewer Connection Approval Water Connection Approval Construction Dewatering Discharge Permit
Boston Department of Public Works	Street Opening Permit Street Occupancy Permit Approval for sign, awning, hood, canopy or marquee
Boston Public Improvement Commission	Street Opening Permit
Boston Civic Design Commission	Design Review
Boston Transportation Dept.	Transportation Access Plan Agreement Construction Management Plan
Brookline Public Works Dept.	Street Opening Permit

1.12 BRA SCOPING DETERMINATION ON THE PROJECT NOTIFICATION FORM

Boston
Redevelopment
Authority

Thomas M. Menino, Mayor
Clarence J. Jones, Chairman
Marisa Lago, Director

22 June 1994

Mr. Paul Clemente
Associate Vice President
for Financial Affairs
Boston University
881 Commonwealth Avenue
Boston, MA 02215

Dear Mr. Clemente:

Re: Center for Photonics Research

Please find enclosed the Scoping Determination for the Boston University Center for Photonics Research Project. The Scoping Determination describes information required by the Boston Redevelopment Authority in response to the Project Notification Form which you voluntarily submitted under Article 31 of the Boston Zoning Code on May 18, 1994. Additional information may be required during the course of review of the project.

If you have any questions regarding the Scoping Determination or the review process, please contact Owen Donnelly at 722-4300, Extension 4271.

We look forward to working with you toward the successful completion of the Project.

Sincerely,

Richard Garver

Richard Garver
Acting Assistant Director for
Institutional Planning and Development

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BOSTON REDEVELOPMENT AUTHORITY

SCOPING DETERMINATION

BOSTON UNIVERSITY

CENTER FOR PHOTONICS RESEARCH

SUBMISSION REQUIREMENTS FOR DRAFT PROJECT IMPACT REPORT (DPIR)

PROPOSED PROJECT:	Boston University: Center for Photonics Research
PROJECT LOCATION:	22 Babbitt Street, Boston, MA, 02215
APPLICANT:	Boston University
PNF SUBMISSION DATE:	May 18, 1994

The Boston Redevelopment Authority ("BRA") is issuing this Scoping Determination pursuant to Section 31-5 of the Boston Zoning Code (the "Code"). The applicant voluntarily filed a Project Notification Form ("PNF") on May 18, 1994. The Scoping Determination requests information required by the BRA for its review of the Proposed Project in connection with the following:

1. Development Review pursuant to Article 31 of the Code;
2. Recommendations to the Board of Appeal with respect to the zoning relief for the Proposed Project, pursuant to Articles 6 and 7 of the Code, and to the Boston Zoning Commission with respect to the Development Plan for the Planned Development Area (PDA) pursuant to Article 3 of the Code;
3. Approval of a Development Impact Project (DIP) Plan, pursuant to Article 26A of the Code, and the agreements for the Development Impact Project Contribution and Jobs Contribution Grant, pursuant to Articles 26A and 26B of the Code; and
4. Review of the project in the context of the Boston University Master Plan 1986-1996 which was approved March 26, 1987.

PREAMBLE

The BRA is reviewing the Proposed Project pursuant to multiple sections of the Code. The Proposed Project is being reviewed pursuant to Article 31, Development Review Requirements, which sets out a comprehensive procedure for project review and requires the BRA to review the design, transportation, environmental, and other impacts of proposed projects. Article 31 requires the submission of a satisfactory Final Project Impact Report ("FPIR") prior to the issuance of a building permit.

The applicant's submittals indicate the Proposed Project requires zoning relief pursuant to Articles 6 and 7 of the Code, Development Impact Project (DIP) Plan approval pursuant to Articles 26A and 26B of the Code and approval by the Boston Redevelopment Authority and the Boston Zoning Commission of the PDA Plan. In order to be granted each type of zoning relief, a different set of criteria must be satisfied.

The Proposed Project requires DIP Plan approval pursuant to Articles 26A, Development Impact Projects - Housing, and 26B, Development Impacts - Job Training. Prior to receiving the zoning relief listed above, the Applicant must meet DIP requirements pursuant to Sections 26A-3 and 26B-3 of the Code. These requirements include that the BRA approve the DIP Plan after a public hearing and that the applicant enter into a DIP Plan Agreement with the BRA.

In conjunction with the zoning relief needed, the applicant is requesting approval of an amendment to its Master Plan.

Boston University proposes to construct a new $70 million Center for Photonics Research on the Charles River Campus at 22 Babbitt Street. The project includes development of a new building, approximately 250,000 square feet of gross floor area, which will replace and upgrade science and engineering academic space and establish new photonics research facilities. The building footprint is approximately 25,600 square feet, and will have nine stories plus a basement. The building will be approximately 165 feet above grade (average) to the top of the mechanical penthouse. The new building program consists of one floor of classroom use, and nine floors of laboratory space (including the basement). The basement floor of the new building is partially above grade and will contain both mechanical and laboratory uses.

The building at 110-112 Cummington Street contains approximately 49,000 square feet of classroom, laboratory and supporting office space. This building will be retained and rehabilitated. There will be a connection from these existing facilities to the new building allowing easy integration of activities and direct access to the science and engineering complex.

The Floor Area Ration (FAR) of the Project will be approximately 6.5, including the new building and the rehabilitated space on Cummington Street. The Project construction is expected to begin in late 1994 and be completed by the end of 1996.

Photonics research is the practical use of light for a broad range of applications including high speed computation, communications, environmental sensing and controls, biological and medical technologies, and information storage. Current applications include telecommunications, surgery, compact disk technology, and supermarket checkout scanners. The impact of photonics today is compared to that of electronics in the 1950s. It is emerging as one of the most important technologies of the future.

It is the goal of the University to establish a world renowned photonics center which will emphasize development and marketing of new products using photonics technology. The photonics industry already accounts for $75 billion per year in revenues and is expected to triple during the next decade. It is hoped that these new photonics facilities will make Boston a market center for photonic activity, creating a new employment base for the city economy.

As part of the Project's building program, the University is taking the opportunity to upgrade and incorporate academic science and engineering space with the Photonics facilities because the uses are complimentary to each other and can serve multiple functions. The Project, therefore, will integrate practical science and engineering education on campus with local industrial research and development. The new building includes "incubator" space for new companies, including small and minority owned businesses as part of the academic facilities. The Center for Photonics Research is planned to be a perpetual resource for businesses and other organizations who otherwise would not have access to a complete array of synthetic, analytical, and fabrication equipment necessary for the development of practical devices and products.

The Boston University Charles River Campus Master Plan 1986-1996 (the Master Plan) was submitted and approved by the City in early 1987. The Project site is located on Parcel K as presented in the Master Plan and also on the site of the adjacent engineering school buildings at 12-22 Babbitt Street and 110-112 Cummington Street. The Master Plan proposes the site as a logical extension of the engineering complex. Parcel K has been acquired and chosen for this Project, which is indeed an integration and extension of the science and engineering complex on campus. The applicant proposes to update the Master Plan to reflect the Project use as proposed.

The Project site is located on Babbitt Street in the western portion of the Boston University Charles River Campus in the area known as the science and engineering complex. The site is bordered by the Massachusetts Turnpike to the south, St. Mary's Street to the west, Babbitt Street to the north, and Cummington Street to the east.

The east side of the site opens onto the engineering complex. The properties across Babbitt Street from the project consist of the back of mixed retail and residential buildings which face Commonwealth Avenue. Across St. Mary's Street from the site are academic buildings. The buildings to the north are used for mixed retail, office and dormitory/residential purposes. To the east are University academic facilities, and across St. Mary's Street on the west side are University academic facilities. The site is surrounded almost exclusively by University owned properties.

The site is approximately 46,205 square feet in size and includes several academic buildings and a small open space on the eastern end. The Project site is basically rectangular in shape and varies in elevation east to west with an approximately 10 foot "dip" in the middle of Babbitt Street. The site is at an average elevation of 21.6 feet Boston City Base.

The Project site is currently zoned M-2.

II. BOSTON UNIVERSITY MASTER PLAN

Boston University has prepared an institutional master plan for the period 1986-1996. The plan was approved by the Boston Redevelopment Authority on March 29, 1987. The Master Plan includes enrollment projections, analyzes housing, parking, academic and recreational needs, and studies potential sites to accommodate the changing needs of the University.

A portion of the Project is proposed for a parcel of land which is identified as Site K in the Master Plan. The balance of the Project site is occupied by University buildings and was not identified as a location for campus expansion. While the uses programmed for the Project are consistent with the Master Plan, the size of the development was not explicitly foreseen. B.U. proposes to amend the Master Plan to reflect the Project. The DPIR should describe and justify the proposed changes to the Master Plan that are necessary to accommodate the Project at the proposed site and identify other changes that may occur elsewhere on the campus as a result of the Project.

III. COMMUNITY REVIEW OF THE PROPOSED PROJECT

The proponent should provide a description of the community review process to-date, as well as the intended process. The description should include the names of neighborhood groups and/or individuals who will be involved, the nature of their role, and a generalized schedule of the process.

IV. DEVELOPMENT REVIEW REQUIREMENTS - ARTICLE 31

SUBMISSION REQUIREMENTS

In addition to full-size scale drawings, 15 copies of a bound booklet containing all submission materials reduced to size 8-1/2" x 11", except where otherwise specified, are required. The booklet should be printed on both sides of the page. In addition, an adequate number of copies must be available for community review. Included in the submission materials should be a copy of this Scoping Determination for review.

A. GENERAL INFORMATION

1. Applicant Information

   a. Development Team

      (1) Names

         (a) Developer (including description of development entity and type of corporation)

         (b) Attorney

         (c) Project consultants

      (2) Business address and telephone number for each

      (3) Designated contact for each

   b. Legal Information

      (1) Legal judgments or actions pending concerning the Proposed Project

      (2) History of tax arrears on property owned in Boston by the Applicant

      (3) Evidence of site control over the project area, including current ownership and purchase options of all parcels in the Proposed Project, all restrictive covenants and contractual restrictions affecting the proponent's right or ability to accomplish the Proposed Project and the nature of the agreements for securing parcels not owned by the Applicant.

(4) Nature and extent of any and all public easements into, through, or surrounding the site.

2. Financial Information (See Appendix 1 for required financial information, which may be submitted under separate cover)

   A Development Pro Forma must be provided for the Proposed Project.

   a. Full disclosure of financing references

   b. Development Pro Forma

3. Project Area

   a. An area map identifying the location of the Proposed Project

   b. Description of metes and bounds of project area or certified survey of project area

4. Public Benefits

   a. Existing and estimated future annual taxes

   b. Anticipated employment levels including the following:

      (1) Estimated number of construction jobs
      (2) Estimated number of permanent jobs

   c. Other public benefits, if any, to be provided

5. Regulatory Controls and Permits

   a. Existing zoning requirements, zoning computation forms, and any anticipated requests for zoning relief should be explained. Clarification is needed as to whether the B.U. proposal constitutes one or two projects with regard to compliance with applicable sections of the Code.

   b. Anticipated permits required from other local, state, and federal entities with a proposed application schedule should be noted.

   c. A statement on the applicability of the Massachusetts Environmental Policy Act (MEPA) should be provided. If the Proposed Project is subject to MEPA, all required documentation should be provided to the BRA, including, but not limited to, copies of the Environmental

Notification Form and the proposed schedule for coordination with BRA procedure.

6. Community Groups

   a. Names and addresses of project area owners, abutters, and also any community or business groups which, in the opinion of the applicant, may be substantially interested in or affected by the Proposed Project.

B. TRANSPORTATION COMPONENT

A Transportation Access Plan shall be prepared as defined by the Scope of Services outlined in Appendix 2.

C. ENVIRONMENTAL PROTECTION COMPONENT

1. Wind

A qualitative analysis of the potential wind impacts of the proposed project at the pedestrian level shall be required for the Draft Project Impact Report. This analysis shall determine potential pedestrian level winds adjacent to and in the vicinity of the project site and shall identify any areas where wind velocities are expected to exceed acceptable levels, including the Authority's guideline of an effective gust velocity of 31 mph not to be exceeded more than 1% of the time. Maps clearly illustrating anticipated wind flow patterns and comfort categories shall be included.

Areas of interest for the analysis shall include public and other areas of pedestrian use, including, but not limited to, entrances to the project buildings, sidewalks adjacent to and in the vicinity of the project buildings, and pedestrian areas in the vicinity of the project development, including the sidewalks of the St. Mary's Street Bridge.

For areas where wind speeds are projected to exceed acceptable levels, measures to reduce wind speeds and to mitigate potential adverse impact shall be identified.

Should the qualitative analysis indicate the possibility of excessive pedestrian level wind speeds, additional studies, including wind tunnel testing, may be required for the Final Project Impact Report.

2. Shadow

Although it will not be the tallest building in the area, the proposed development is twice the height of any of the adjacent structures. The proposal will have shadow impacts on the adjacent residential structure and could have impacts on the historic Cram buildings and the pedestrian environment on Commonwealth Avenue. Complete shadow analysis is required to fully understand the potential impacts and what mitigation measures would be appropriate.

The shadow analysis shall be required for existing and build conditions for the hours 9:00 a.m., 12:00 noon, and 3:00 p.m. for the vernal equinox, summer solstice, autumnal equinox, and winter solstice. It should be noted that due to time differences (daylight savings vs. standard), the autumnal equinox shadows would not be the same as the vernal equinox shadows and therefore separate shadow studies are required for the vernal and autumnal equinoxes.

The shadow impact analysis must include new shadow from the proposed building as well as existing shadow from adjacent existing buildings and must clearly show the incremental impact of the proposed new building. A North arrow shall be provided on all figures.

Particular attention shall be given to existing or proposed public open spaces and major pedestrian areas, including, but not limited to, the sidewalks adjacent to and in the vicinity of the proposed project and pedestrian areas and other public open spaces within the project vicinity.

Design or other mitigation measures to limit or avoid any adverse shadow impact shall be identified.

3. Daylight Analysis

A daylight analysis is required, taking three viewpoints. One viewpoint should be taken from St. Mary's Street, a second should be taken from the Massachusetts Turnpike, and the third should be taken from Babbitt Street, all centered on the corresponding new portion of the facade. Comparison should be made to values for the as-of-right zoning "envelope" for the site. (A comparison to downtown values is not appropriate.) The BRADA program must be used.

4. Air Quality

A description of the exhaust system of the project's research laboratories, including location of intake and exhaust vents and specifications, and an analysis of the impact on pedestrian level air quality from operation of the exhaust system shall be required. Potential emissions of any air contaminants from the project's laboratories shall be identified and quantified. Measures to prevent or control the release of such contaminants and to avoid any violation of air quality standards shall be described. Air quality both inside and outside of the project may be a somewhat more complex issue because of its adjacency to the Mass. Pike, a qualitative evaluation should be included in the DPIR.

An analysis of the potential emission of pollutants from any space heating and steam facilities of the proposed project and a description of measures to minimize the emission of pollutants also shall be included in the DPIR. Required State permits for on-site boilers shall be described, if applicable.

5. Water Quality

Sewage from the proposed project may include process waste water from the project's laboratories. The DPIR shall identify any chemical components which will be discharged into the sanitary waste stream and shall quantify their anticipated concentrations. Measures to eliminate the introduction of contaminants into the waste stream, as well as to prevent the disposal of hazardous substances, shall be described.

Federal, State, and municipal permits regulating sewer connection, use, and discharges shall be described.

6. Solid and Hazardous Wastes

The presence of any contaminated soil or groundwater shall be evaluated and remediation measures to ensure their safe removal and disposal shall be described. The assessment of site conditions pursuant to the requirements of M.G.L. Chapter 21E should be included in the DPIR, together with appropriate maps, tables, and data.

The DPIR shall describe the generation, storage, and disposal of all solid wastes from the operation of the proposed project, with particular emphasis on the generation of any hazardous wastes or contaminants from research activities. The DPIR shall identify the specific nature of the hazardous wastes and the quantities to be generated and shall describe the management and disposal of these wastes. Measures to prevent the release of any contaminants shall be described.

In addition, measures to promote the reduction of waste generation and recycling, particularly for paper and other recyclable products, shall be described in the DPIR.

7. Noise and Vibration

An analysis of the potential noise impacts from the project's mechanical and exhaust systems and compliance with applicable regulations of the City of Boston shall be required. A description of the project's mechanical and exhaust systems and their location shall be included. Measures to minimize and eliminate adverse noise impacts on nearby sensitive receptors, including the dormitories along Commonwealth Avenue, shall be described.

Sensitive laboratory equipment is proposed to be located in the basement level of the proposed structure. Traffic from the adjacent Massachusetts Turnpike Extension and the B&A railroad tracks could produce adverse vibration impacts within the building, particularly in the lower levels. The DPIR should evaluate the potential vibration impacts on the project and describe appropriate mitigation measures to eliminate any adverse effects.

8. Geotechnical Impact

An analysis of existing sub-soil conditions, groundwater levels, potential for ground movement and settlement during excavation, and potential impact on adjacent buildings, utility lines, and the adjacent Massachusetts Turnpike Extension shall be required. This analysis shall also include a description of the foundation construction methodology, the amount and method of excavation, and measures to prevent any adverse effects on adjacent buildings, utility lines, and the Massachusetts Turnpike Extension.

Measures to ensure that groundwater levels will not be lowered during or after construction also shall be described.

9. Construction Impacts

A construction impact analysis shall include a description and evaluation of the following:

(1) potential dust and pollutant emissions and mitigation measures to control these emissions.

(2) potential noise impact and mitigation measures to minimize increase in noise levels.

(3) location of construction staging areas and construction worker parking.

(4) construction schedule, including hours of construction activity.

(5) access routes for construction trucks and anticipated volume of construction truck traffic.

(6) method of demolition of the existing buildings on the site, control of emissions, asbestos removal, and disposal of demolition waste, including identification of disposal site.

(7) generation and disposal of construction debris.

(8) potential for the recycling of demolition debris from the site.

(9) impact of project construction on rodent populations and description of the proposed rodent control program, including frequency of application and compliance with applicable City and State regulatory requirements.

(10) measures to protect the public safety.

D. URBAN DESIGN COMPONENT

The proposed building fronts on the Turnpike and Saint Mary's Street, both important for providing views and entries to the campus. The building massing should consider views from not only the Turnpike but also the approach from St. Mary's Street.

The proponent has indicated that the building program will be organized vertically with each floor organized with laboratory space on the south side and office on the north. Further study should be given to how the design of these facades might respond to these organizational and environmental differences. Also, consideration should be given to the use of varying bay rhythms or variations in the plane of the facades to give some relief to what is a rather monolithic building. Extending the central bay through the roof plane or breaking it beyond the vertical plan of the facade might also be studied. The use of brick provides additional opportunities to add variety and interest to the facade through cornice, lintel and sill details.

The proposed building has a street frontage that covers 160 feet or over 75% of the Babbitt Street block between St. Mary's Street and Cummington Street. However the only active frontage or visual penetration provided on that block is the building entrance. The proponent should investigate opportunities to present a more friendly and positive pedestrian environment by placing windows on the street level. Consideration should also be given to streetscape design including trees, sidewalks of a minimum of eight feet and pedestrian scale lighting. The following standard items must be included in the schematic submission.

1. A written description of program elements and space allocation for each element.

2. A table showing the gross floor area, floor by floor and totals, of the proposed building.

3. A plan of the surrounding area at an appropriate scale (1" = 40' or larger) showing relationships of the Proposed Project to the district with regard to:

    a. building footprint

    b. building height

    c. open space

    d. major topographic features

    e. pedestrian and vehicular circulation routes and entry points

    f. land use

4. Site sections at 1" = 40' or larger showing relationships of the Proposed Project to adjacent buildings and spaces.

5. Black and white 8"x10" photographs of the site and neighborhood.

6. An eye-level perspective (reproducible line drawings) showing the proposal in the context of the surrounding area

7. Aerial views of the project in the context of the surrounding area.

8. Sketches, diagrams, and photographs where relevant, to clarify design issues and massing.

9. A site plan at an appropriate scale (1" = 40' or larger) showing:

    a. specific relationships of the Proposed Project to existing adjacent buildings, streets and open space

    b. general location of pedestrian ways, driveways, parking, service areas, streets, and major landscape features

    c. pedestrian, handicapped, vehicular and service access and flow through the parcel and to adjacent areas

   d. survey information, such as existing elevations, benchmarks, and utilities and

   e. construction limits

10. Massing models at 1" = 40'.

11. Elevations, sections, and plans at 1"-16' showing building entrances and programming.

12. Proposed schedule for submittal of design development materials.

In addition to the standard plans and elevations required for the schematic submissions, the following information must be prepared:

1. Site Plan showing sidewalks, street amenities including plantings and lighting, pedestrian and servicing entrances and adjacent structures including building entrances.

2. Building section extending to the buildings on the north side of Commonwealth Avenue to show the relationship to the Cram buildings.

3. Street-level perspectives viewing the building from the north side of Commonwealth Avenue, from the east at the Hindsdale intersection and from the west at the Carlton Street Bridge intersection to show its relationship to existing Commonwealth Avenue.

4. Elevations showing the building in context with particular attention being paid to fenestration patterns and entry and service locations.

Submission materials for Design Development and Contract Documents submissions can be found in Appendix 3.

E. HISTORIC RESOURCES COMPONENT

The proposed project site is located in the vicinity of a number of National and State designated historic properties and districts. The historic resources analysis shall assess the potential impacts of the proposed project's height, scale, massing, architectural design, and other relevant environmental factors (including shadow) on the historic districts and properties in the vicinity of the proposed development. The DPIR also must assess the potential presence of any archaeological resources which may be disturbed by the construction of the proposed project. Prior consultation with the City of Boston archaeologist (Mr. Steven Pendery, 635-3850) is advised.

F. INFRASTRUCTURE SYSTEMS COMPONENT

An infrastructure impact analysis must be performed. The discussion of Proposed Project impacts on infrastructure systems should be organized system-by-system as suggested below. The applicant's submission must include an evaluation of the Proposed Project's impact on the capacity and adequacy of existing water, sewerage, energy (including gas and steam), and electrical communications (including telephone, fire alarm, computer, cable, etc.) utility systems, and the need reasonably attributable to the proposed project for additional systems facilities.

Any system upgrading or connection requiring a significant public or utility investment, creating a significant disruption in vehicular or pedestrian circulation, or affecting any public or neighborhood park or streetscape improvements, comprises an impact which must be mitigated. The DPIR must describe anticipated impacts in this regard, including specific mitigation measures, and must include nearby Proposed Project buildout figures in the analysis.

In the case of the Center for Photonics Research project, particular consideration should be given to the location and configuration of connections, separation of storm drain and sanitary sewer systems, and interface with any unusual conditions brought about by the location adjacent to the Mass. Pike.

1. Water and Sewer Systems

The Water and Sewer Systems Analysis must include the following:

a. Estimated water consumption and sewerage generation from the Proposed Project and the basis for each estimate. Include separate calculations for air conditioning system make-up water.

b. Description of the capacity and adequacy of water and sewer systems and an evaluation of the impacts of the Proposed Project on those systems. This evaluation should take into account the age of the system components adjacent to the site.

c. Identification of measures to conserve resources, including any provisions for recycling.

d. Description of the Proposed Project's impacts on the water quality of the Charles River or other water bodies that could be affected by the project. Include the impact of on-site storm drainage on water quality. Description of mitigation measures to reduce or eliminate impacts on water quality.

e. Detail methods of protection proposed for BWSC sewer lines and water mains during construction.

f. Brief description of fire protection system and connections.

Some expansion of the material in the PNF on this matter is suggested. Thorough analysis and continuing discussions with BWSC are required.

Water supply systems adjacent to the project and servicing the project should be looped so as to minimize public hazard or inconvenience in the event of a main break.

2. Energy Systems

The Energy Systems Analysis must include the following:

a. Description of energy requirements of the project and evaluation of project impacts on resources and supply. Information is required regarding Boston Edison's ability to supply electrical energy for project needs.

b. Description of measures to conserve energy usage and consideration of the feasibility of including solar energy provisions or other on-site energy provisions.

c. Detail the energy source of the interior space heating; how obtained, and, if applicable, plans for reuse of condensate.

d. Brief description of emergency power capabilities.

The location of transformer and other vaults required for electrical distribution or ventilation must be chosen to minimize disruption to pedestrian paths and public improvements both when operating normally and when being serviced, and must be described.

3. Other systems should be included in similar analyses if applicable: gas, steam, telephone, cable, fiberoptic communications, etc.

Appendix 1

REQUIRED FINANCIAL INFORMATION

REQUIRED FINANCIAL INFORMATION
BOSTON UNIVERSITY
CENTER FOR PHOTONICS RESEARCH

DEVELOPMENT PRO FORMA includes all the information normally found in a development pro forma, by phase. This includes, but is not limited to:

- o Land costs, per land square foot and total, by parcel, including any incremental disposition cost attributed to the project.

- o Attribution of acquisition expense over project components (per FAR square foot retail, office, parking, etc.)

- o All hard costs on a per-unit and total basis (disaggregated into base building, tenant improvement work, site work, furniture, fixtures and equipment, FF&E, etc.)

- o All soft costs on a per-unit and total basis, (disaggregated into individual line items such as architectural, engineering, legal, accounting, and developer's fees, and any other professional fees, insurance, permits, etc.)

- o All contingencies, on a per-unit and total basis, by phase (specify whether contingency is on hard costs, soft cost, or total cost).

- o All assumptions regarding financing terms on acquisition, pre-development, construction and permanent loans, by phase (including financing fees, interest rates, drawdown assumptions, terms, participations, amortization).

- o Any other project-related expenses not within any of the above categories.

- o Calculation of Total Development Cost (TDC) by component, including total and per unit breakdown (e.g., per square foot office, retail, parking, etc.).

- o Sources of debt and equity for total project costs.

- o Projected financing sources, including bond issuing agencies such as HEFA or MIFA, banks, institutional investors, private, corporate or government donors (an analysis of the costs versus benefits of the financing options, including interest costs and loan terms, as well as a comparison between available sources, should be included).

Appendix 2

TRANSPORTATION ACCESS PLAN
SCOPE OF SERVICES

ACCESS PLAN SCOPE
BU PHOTONICS CENTER

Since the Photonics Center project does not include the construction of any new parking, it will not generate substantial new vehicular traffic to the site. It will, however, generate traffic to existing parking facilities. The Access Plan should focus on total trip generation and parking issues.

In connection with approvals for the School of Management project, the University will commit to performing a campus-wide transportation master plan as part of its next master plan update. Analysis of overall impacts of the University will be done at that time.

Trip Generation

The proposed uses of the site will be evaluated to determine the project's person-trip generation characteristics, which will be translated into vehicle trips by use of modal split and vehicle occupancy assumptions consistent with existing conditions in comparable facilties. Daily, AM and PM peak hour trips should be presented by mode.

Trip Distribution

Trip distribution estimations should be made of the probable origin of work and non-work trips to the site, on the basis of potential employee pool and the operating characteristics of the facility. Trip distribution is most appropriately described in terms of corridor of origin, e.g. Northwest, Southeast, etc.

Site Circulation

A detailed site plan will be provided, showing proposed location of all vehicular and pedestrian access, drop-off locations, taxi waiting areas, delivery points, and internal pedestrian circulation.

Trucks and Service Vehicles

Truck and service vehicle traffic to the site will estimated. Access and egress for emergency vehicles will also be evaluated.

Parking Impacts

On the basis of the traffic volumes projected above, and using appropriate turnover rates, estimate project-generated parking demand. Parking supply at off-site locations will be identified, for employees and visitors. Displacement of existing on-site spaces will be noted, and replacement of same at new off-site locations.

Appendix 3

SUBMISSION REQUIREMENTS FOR DESIGN DEVELOPMENT AND CONTRACT DOCUMENTS SUBMISSIONS

PHASE II SUBMISSION: DESIGN DEVELOPMENT

1. Revised written description of project.

2. Revised site sections.

3. Revised site plan showing:

    a. Relationship of the proposed building and open space and existing adjacent buildings, open spaces, streets, and buildings and open spaces across streets.

    b. Proposed site improvements and amenities including paving, landscaping, lighting and street furniture.

    c. Building and site dimensions, including setbacks and other dimensions subject to zoning requirements.

    d. Any site improvements or areas proposed to be developed by some other party (including identification of responsible party).

    e. Proposed site grading, including typical existing and proposed grades at parcel lines.

4. Dimensioned drawings at an appropriate scale (e.g., 1"=8') developed from approved schematic design drawings which reflect the impact of proposed structural and mechanical systems on the appearance of exterior facades, interior public spaces, and roofscape including:

    a. Building plans

    b. Preliminary structural drawings

    c. Preliminary mechanical drawings

    d. Sections

    e. Elevations showing the project in the context of the surrounding area as required by the Authority to illustrate relationships of character, scale and materials.

5. Large-scale (e.g., 3/4"=1'-10") typical exterior wall sections, elevations and details sufficient to describe specific architectural components and methods of their assembly.

6. Outline specifications of all materials for site improvements, exterior facades, roofscape, and interior public spaces.

7. Eye-level perspective drawings showing the project in the context of the surrounding area.

8. Samples of all proposed exterior materials.

9. Complete photo documentation (35 mm color slides) of above components including major changes from initial submission to project approval.

PHASE III SUBMISSION: CONTRACT DOCUMENTS

1. Final written description of project.

2. A site plan showing all site development and landscape details for lighting, paving, planting, street furniture, utilities, grading, drainage, access, service, and parking.

3. Complete architectural and engineering drawings and specifications.

4. Full-size assemblies (at the project site) of exterior materials and details of construction.

5. Eye-level perspective drawings or presentation model that accurately represents the project, and a rendered site plan showing all adjacent existing and proposed structures, streets and site improvements.

6. Site and building plan at 1"-100' for Authority's use in updating its 1"=100" photogrammetric map sheets.

PHASE IV SUBMISSION: CONSTRUCTION INSPECTION

1. All contract addenda, proposed change orders, and other modifications and revisions of approved contract documents which affect site improvements, exterior facades, roofscape, and interior public spaces shall be submitted to the Authority prior to taking effect.

2. Shop drawings of architectural components which differ from or were not fully described in contract documents.

2.0 PROJECT DESCRIPTION

2.0 PROJECT DESCRIPTION

2.1 INTRODUCTION

The purpose of this chapter is to provide a complete description of the Center for Photonics Research project including the existing conditions on the site, the project phases, and the Research Center uses and design elements. The chapter also discusses the Project in the context of the campus and urban setting.

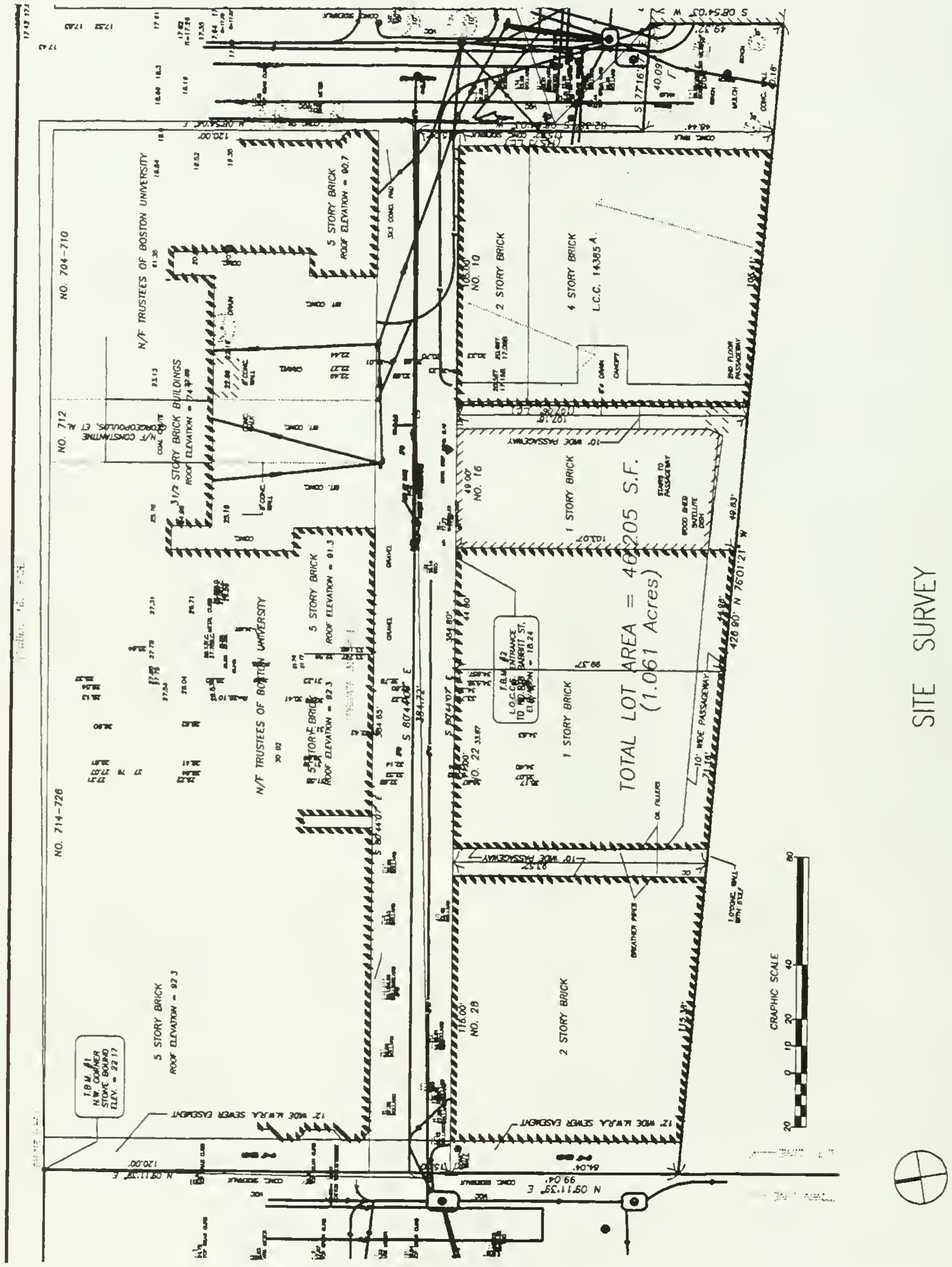
2.2 SURROUNDING AREA

The Center for Photonics Research is located in the western portion of the Boston University Charles River campus in the area known as the science and engineering complex . The Project site is located on the south side of Babbitt Street. The site is bordered by the Massachusetts Turnpike to the south, St. Mary's Street to the west, Babbitt Street to the north, and Cummington Street to the east. The east side of the site opens onto the science and engineering complex. On the north side, the back of mixed retail and residential buildings abut Babbitt Street and the front of these buildings face Commonwealth Avenue. Across St. Mary's Street from the site are academic buildings. To the east are University academic facilities, and across St. Mary's Street on the west side are University academic facilities.

2.3 EXISTING CONDITIONS

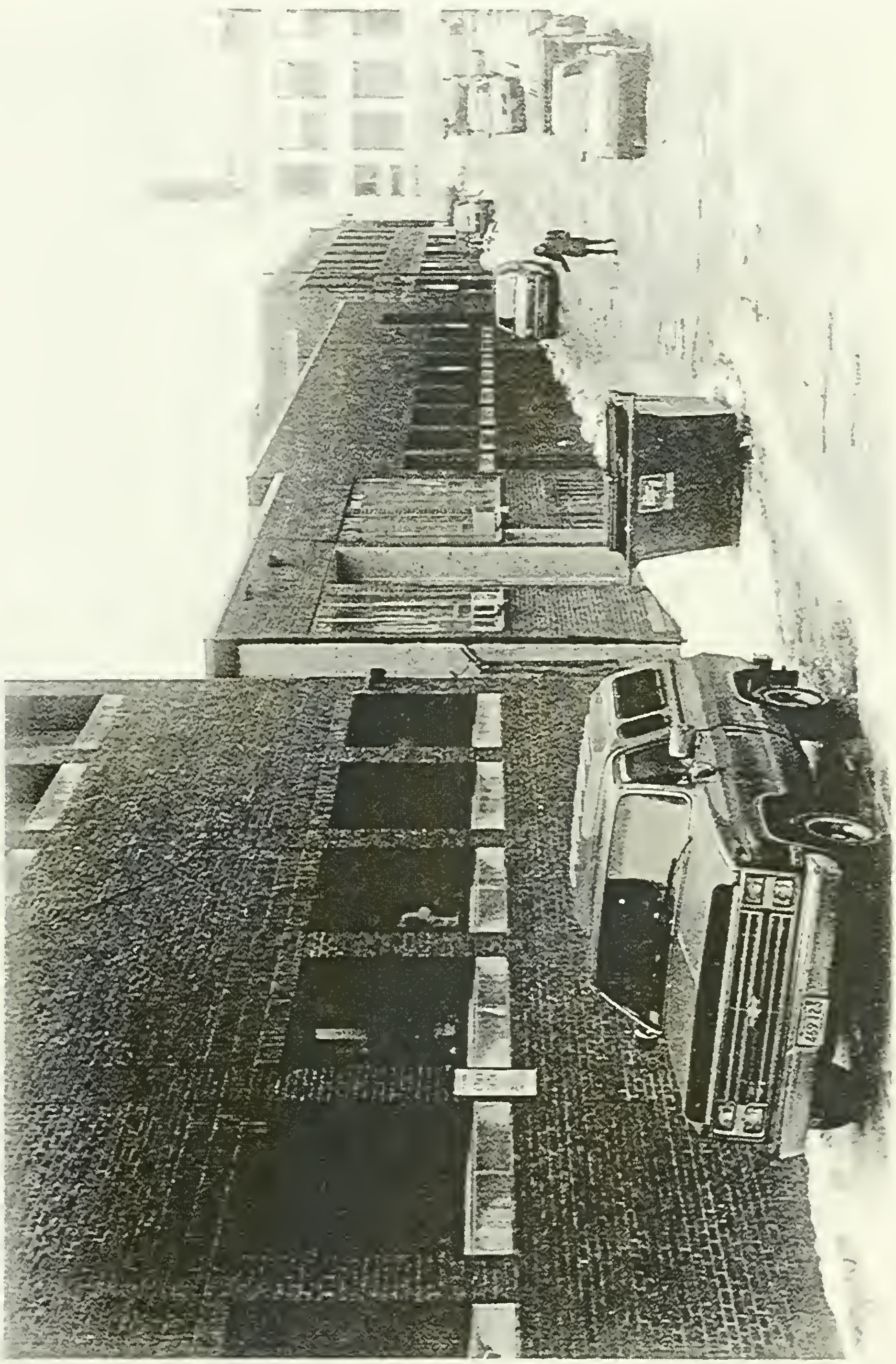
The Project site is approximately 46,205 square feet in size and is basically rectangular in shape varying in elevation east to west with an approximate 10 foot "dip" in the middle of Babbitt Street. The site is at an average elevation of 21.6 feet Boston City Base. Currently the site is occupied by a vacant building, several academic buildings and a small open space on the eastern end. The buildings on site contain a total of approximately 94,200 square feet including approximately 17,000 square feet of space in the vacant building. The remaining space contains approximately 77,200 square feet of academic uses including, classrooms, laboratory, administrative and faculty offices. The existing buildings on the Project site are summarized below in Table 2-1.

The site is surrounded almost exclusively by University owned properties. Figures 2-1 through 2-5 show the site survey and views of existing conditions at the site.



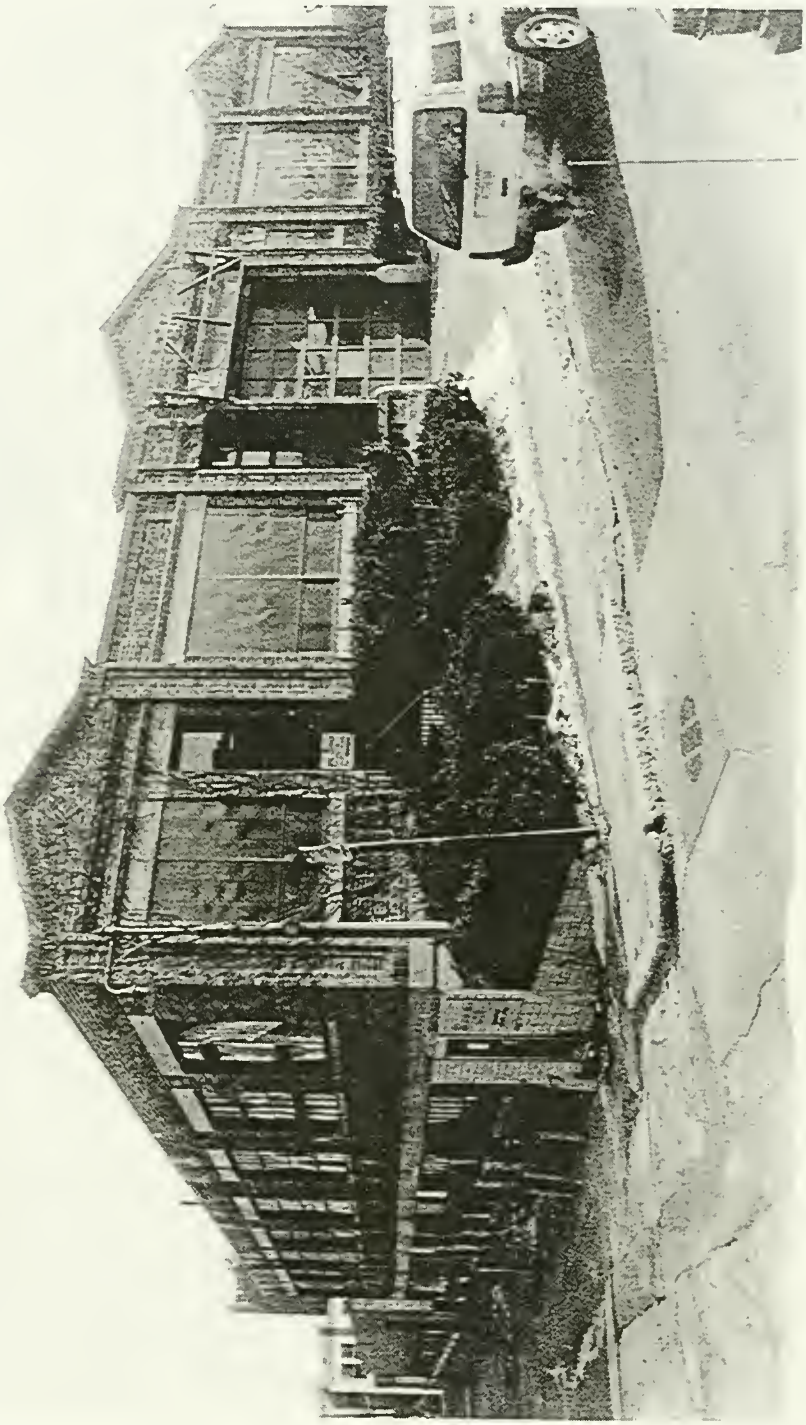
Site Survey

Prepared By: Cannon	***Figure 2-1***



Babbitt Street Looking West

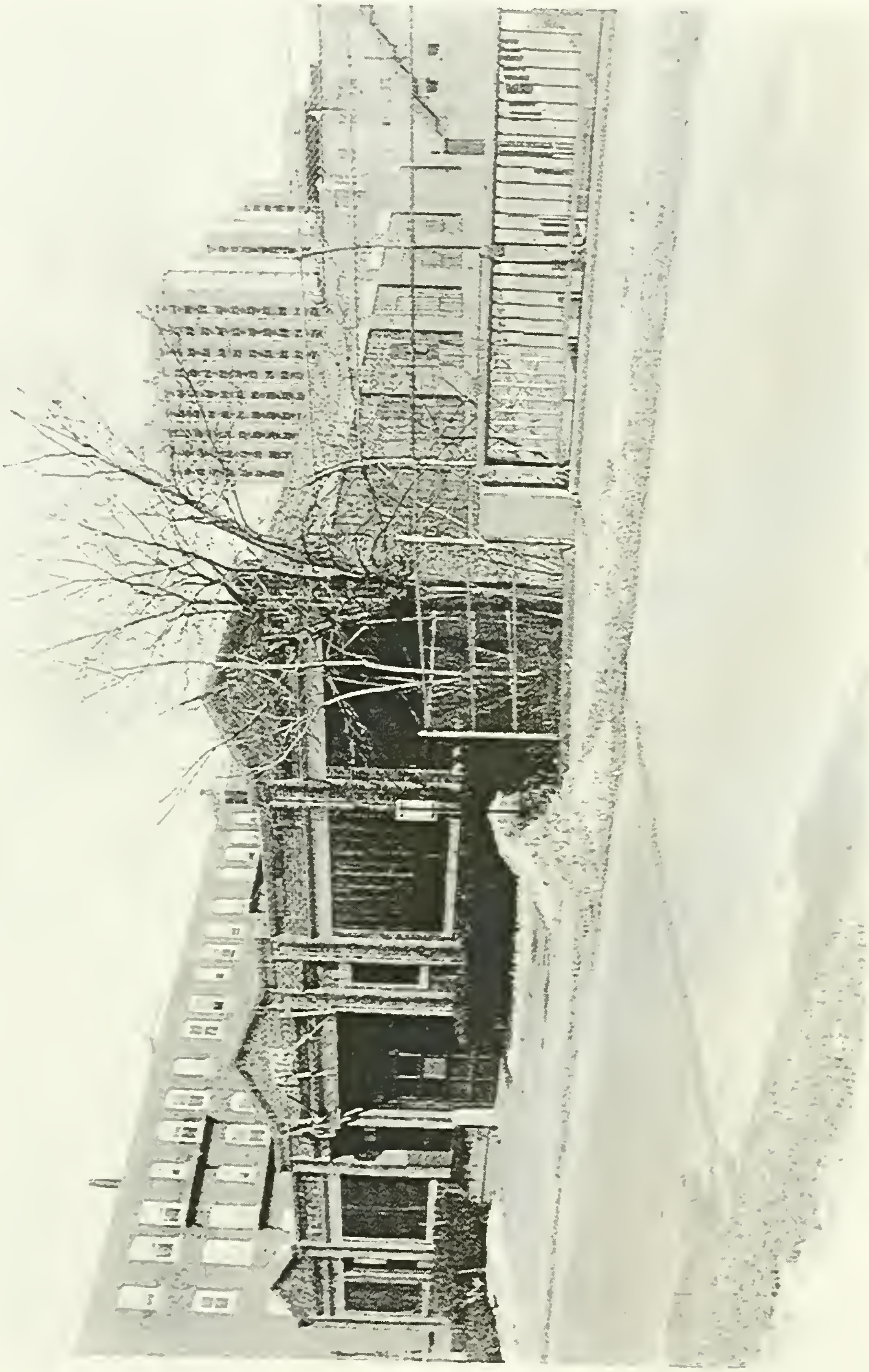
Prepared By: Cannon	***Figure 2-2***



Babbitt Street Looking East

Prepared By:
Cannon

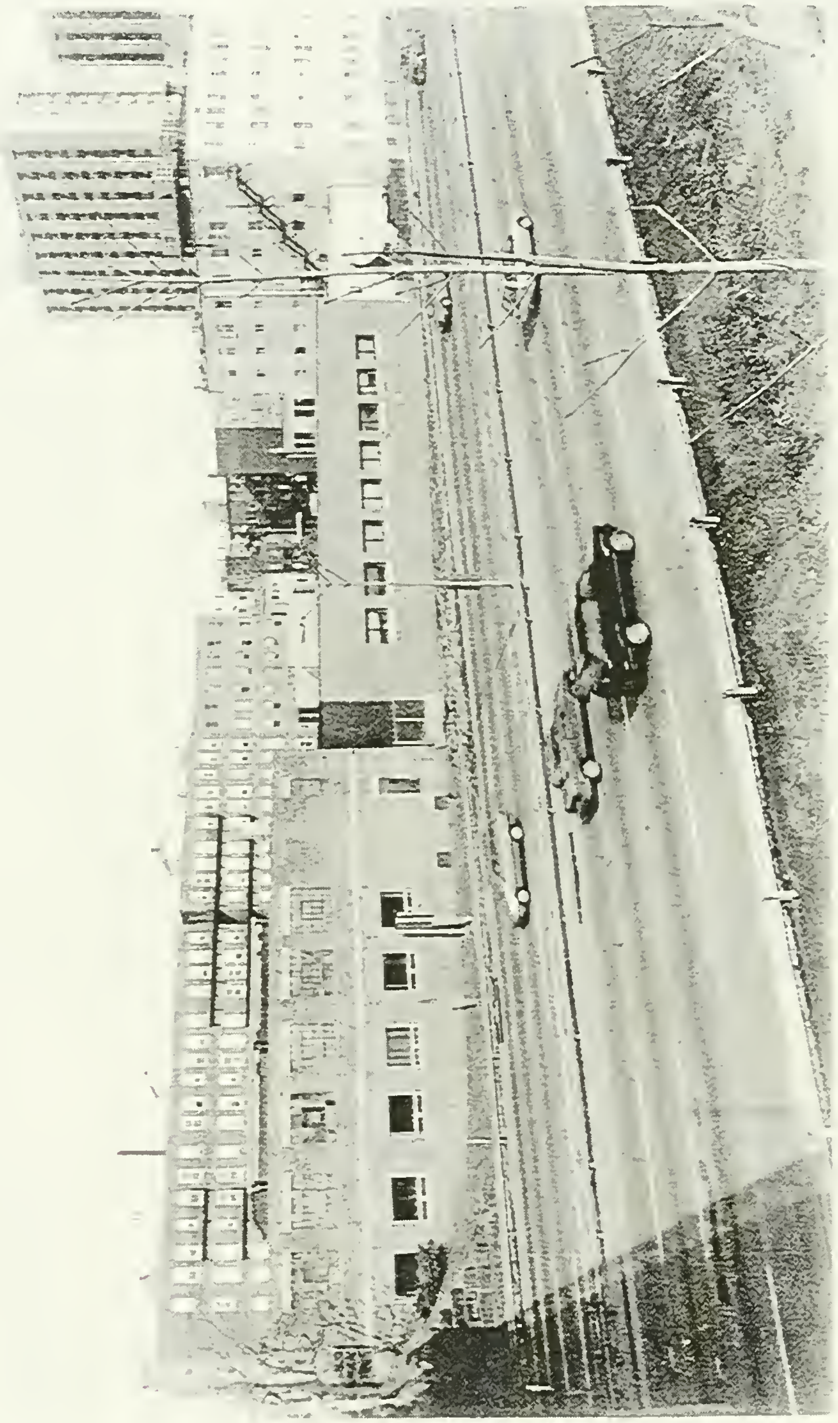
Figure 2-3



St. Mary's Street Looking Northeast

Prepared By:
Cannon

Figure 2-4



Massachusetts Turnpike Looking North

Prepared By:
Cannon

Figure 2-5

TABLE 2-1
Existing Buildings (Approximate Square Footage)

Address	Square Feet	Uses
8 St. Mary's Street	17,000	Vacant
12 Babbitt Street	8,200	Engineering School
18-22 Babbitt Street	21,400	Engineering School
110-112 Cummington Street	47,600	Engineering School
Total	**94,200**	

2.4 PROJECT OBJECTIVES

The Center for Photonics Research project has essentially three major goals:

- to establish high quality interdisciplinary photonics research facilities which will emphasize development and marketing of new products;
- to maximize the use of the site with appropriate academic uses which will enhance the University science and engineering complex; and
- to create a unique facility that integrates education, academic research, and commercial product development.

Photonics is the practical use of light for civilian and military applications. Photonics research covers a broad spectrum of activities such as: development of blue and ultraviolet lasers; a new generation of optical microscopes with ten time the resolution of typical microscopes; biomolecular photonic materials used in medicine; environmental sensing and control instruments; devices for fiber optic communication systems; high density optical data storage compact disk; and checkout scanners, to name a few.

The University received a $29 million grant from the Department of Defense (DOD), which includes $16 million to design and construct an interdisciplinary research center, $4.8 million for equipment, and $8.2 million to develop and operate innovative research programs which focus on the development of photonics materials, photonics devices and systems; and photonics communications, management, and training.

The $29 million grant from DOD provides a catalyst for the University to go beyond the requirements of the grant to develop a $75 million state-of-the-art building which will house the Center for Photonics Research and establish on-going photonics research, development, and education programs. The Research Center will contain a complete array of synthetic, analytic, and fabrication equipment and house the programs and training facilities discussed in the grant. These research facilities will also provide "incubation" space which will serve as a perpetual resource for businesses and organizations who otherwise would not have access to quality facilities.

It is the University's goal that the Research Center will establish Boston as a market center for the multi-billion dollar photonics research industry. The Project will not only foster the development of new technology but will foster the creation of new jobs in the photonics industry. Accordingly, the Research Center must provide the appropriate mix and quality facilities that will allow the center to take and hold a leading role now and in the future.

The campus Master Plan identifies this area as a logical extension of the science and engineering complex on campus allowing the Research Center activities to be integrated with other science and engineering research. The Project provides an opportunity to upgrade academic science and engineering facilities and to integrate science and engineering education with practical commercial product research and development. It is intended that the Research Center foster the integration of academic and commercial research and offer practical training for engineering students by involving them in the development of commercial products. Accordingly, the Project not only includes the development of new facilities but includes integration with existing engineering facilities in 110-112 Cummington Street thereby extending the science and engineering complex. The Project also capitalizes on the opportunity to upgrade and beautify Babbitt Street which is currently a substandard street.

The building design aspires to achieve the goals by:

- providing quality academic and research facilities which meet the needs of the University and the requirements of the grant;
- creating a landmark building which reflects the important scientific research activities inside;
- providing a noticeable gateway to campus from the south, while integrating with the character of the urban campus.

2.5 PROJECT PROGRAM

The Center for Photonics Research project includes three phases. The first phase involves demolition of approximately 46,600 gross square feet[1] of the existing buildings at 12 Babbitt Street, 18-22 Babbitt Street, and 6-8 St. Mary's Street. On this portion of the site the new Center for Photonics Research building will be developed containing approximately 230,500 gross square feet of research, classroom and supporting office space. The last phase of the Project will involve modest renovations to the 110-112 Cummington Street building including corridor connections to the Research Center and modifications to the building mechanical systems. A summary of the building program is provided in Table 2-1.

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[1] Gross square feet as defined in the Boston Zoning Code.

TABLE 2-2
Center for Photonics Research Building Program Summary

Research Center **Floor**	**Gross Square Feet***	**Function**
Basement	16,400	Photonics -- laboratory, mechanical systems
First Floor	22,400	Engineering -- classroom, laboratory, office, loading, building entrance
Second Floor	23,000	Engineering -- classrooms, lecture hall, laboratory, building entrance
Third Floor	23,500	Engineering -- laboratory, office
Fourth Floor	25,000	Engineering -- laboratory, office
Fifth Floor	23,900	Engineering -- laboratory, office
Sixth Floor	23,900	Photonics -- laboratory, office
Seventh Floor	25,000	Photonics -- laboratory, office
Eighth Floor	22,900	Photonics -- laboratory, office
Ninth Floor	22,900	Photonics -- laboratory, office, seminar room
Penthouse	1,600	Mechanical
Total	**230,500**	
110-112 Cummington Street		
Basement	10,200	Engineering -- laboratory, office
First Floor	10,700	Engineering -- laboratory, office, classroom
Second Floor	10,700	Engineering -- laboratory, office, classroom
Third Floor	8,000	Engineering -- laboratory, office
Fourth Floor	8,000	Engineering -- laboratory, office
Total	**47,600**	
PROJECT TOTAL	**278,100**	

* Gross square feet as defined in the Boston Zoning Code

2.5.1 RESEARCH CENTER BUILDING PROGRAM

The Research Center will contain approximately 230,500 gross square feet of research laboratory space, classrooms and lecture hall, and supporting office and administration space in a nine story building. The building will be approximately 165 feet above average grade to the top of the mechanical penthouse house. The building footprint will be approximately 26,500 square feet to the outside of the building.

The basement floor of the new building is partially above grade and will contain space for building mechanical systems and photonics laboratories. The first and second floors will contain engineering laboratories, the lecture hall, and new and replacement classroom space. These academic activities are integrated into the rest of the science and engineering complex through connections on the first and second floors to the 110-112 Cummington Street building which faces the complex. The academic activities are further visually connected by an atrium between the first and second floors. This atrium is centrally situated at the Babbitt Street entrance.

Floors four through five will contain engineering laboratories with supporting office and administrative space. Floors six through eight will contain photonics laboratories and supporting office and administration space. The sixth floor will include the "incubator" laboratories. The ninth floor will house the photonics administration space and also a seminar room, library, and small conference rooms which support activities in the building. A second atrium is included in the building between the sixth and ninth floors providing a vertical connection of the photonics research and administration activities. Floor plans and elevations for the Research Center are provided in Figures 2-6 through 2-15.

The Floor Area Ratio (FAR) of the Project will be approximately 6.0 including the new Research Center and the existing 110-112 Cummington Street building.

2.5.2 RENOVATION PROGRAM

The building at 110-112 Cummington Street contains approximately 47,600 square feet of classroom, laboratory and supporting office space. This building will be retained as part of the Project. Modest renovations will be made to the building including connections to the first and second floors of the Research Center allowing easy integration of activities and direct access to the science and engineering complex. A minor connection between the two buildings will be provided for service and maintenance purposes. Renovations will also include enhancement of the building entrance and corridors which connect to the Research Center.

The Project includes upgrading the electrical and mechanical systems in the 110-112 Cummington Street building. The Research Center electrical, heating and cooling systems are sized to include service to both buildings. The Research Center will backfeed electricity to the 110-112 Cummington Street building allowing the removal of the old transformer in the basement. The Research Center will also backfeed heating and cooling requirements to the existing building allowing removal the boilers, estimated to be at least 30 years old, and rooftop air handling units. The renovation activities will also include upgrading of telecommunications and electrical service to the building. (Also see Chapter 14.0, Infrastructure).

It is expected that backfeeding 110-112 Cummington Street will improve the efficiency of the building and also enhance the final Project design by eliminating unsightly exterior mechanical equipment.

2.5.3 STREETSCAPE AND ACCESS

The Center for Photonics Research will have several pedestrian access points serving the building. Pedestrian access connections will be provided from the 110-112 Cummington Street building into the first and second floors of the east side of the Research Center. This arrangement will provide a direct connection to the rest of the University science complex. Two additional pedestrian access points to the new building are included in the building program. One entrance is provided from Babbitt Street at the first floor level. A second entrance is provided on St. Mary's Street at the second floor level. These entrance arrangements will provide an interior alternative to a pedestrian who does not want to use Babbitt Street during inclimate weather. Loading and servicing facilities for the new building are located on Babbitt Street away from the main entrance. A Project access plan is provided in Figure 2-16. Details of entrances are provided in the First and Second floor plans in Figures 2-6 and 2-7 respectively.

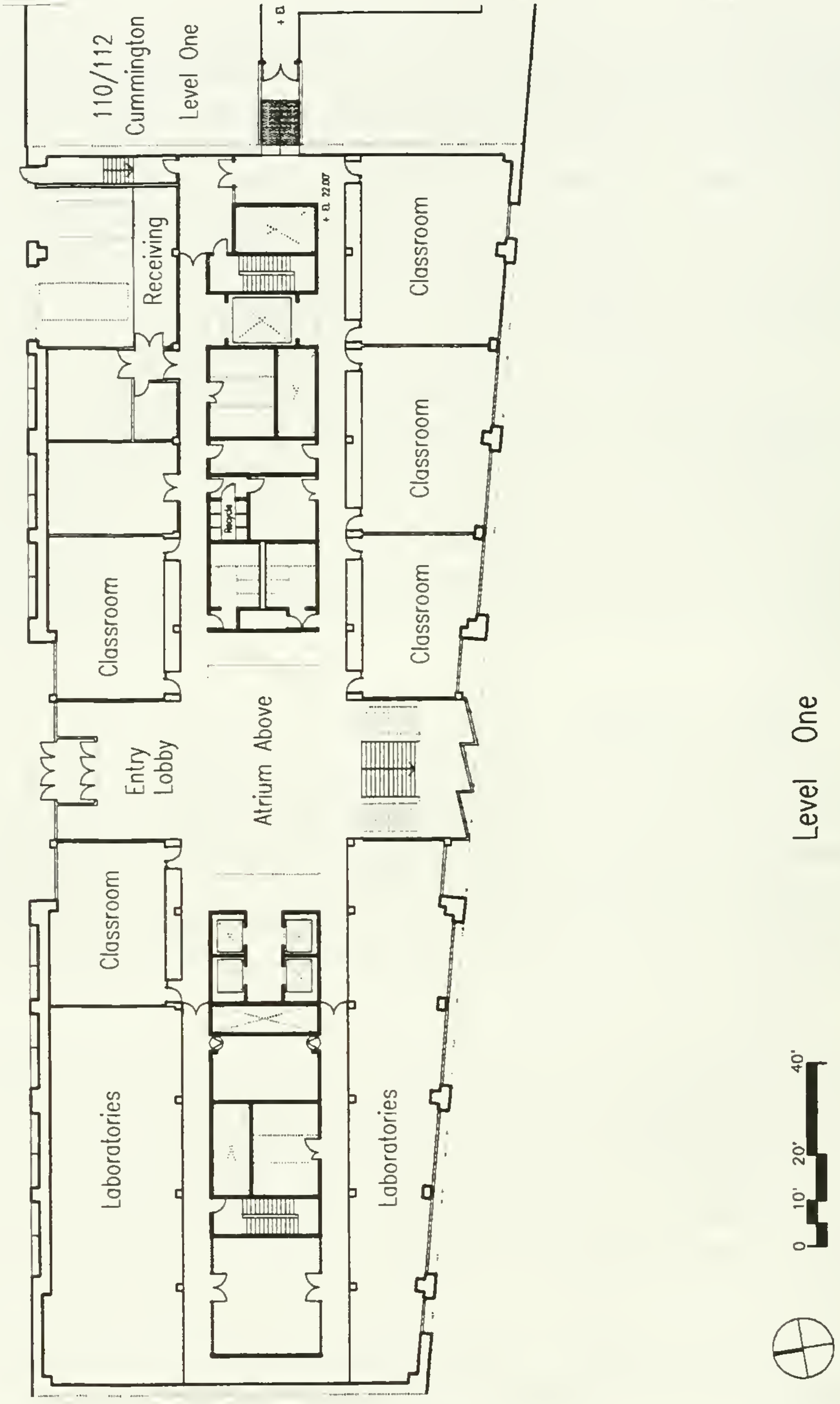
The Project includes major improvements to Babbitt Street which is currently a substandard and unsightly alley. The whole of Babbitt Street will be upgraded with regrading and drainage improvements and will be repaved. A new sidewalk will be created along the south side of the street which segregates pedestrian from vehicular traffic. New lighting fixtures will be installed along the street and, to the extent possible, there will be new landscaping along the Project site. St. Mary's Street entrance will also be enhanced with new lighting and landscaping. All entrances and pedestrian ways on the Project site will comply with state and federal accessibility requirements.

2.6 URBAN DESIGN

The design of the Center for Photonics Research takes into account a combination of factors in addition to the program needs for the building. The design of the building reflects the importance of the research activities inside, the characteristics of the University science and engineering complex in the context of the Charles River campus, and the dense urban fabric of the larger area. Neighboring uses and site restrictions also play a role in the Project design.

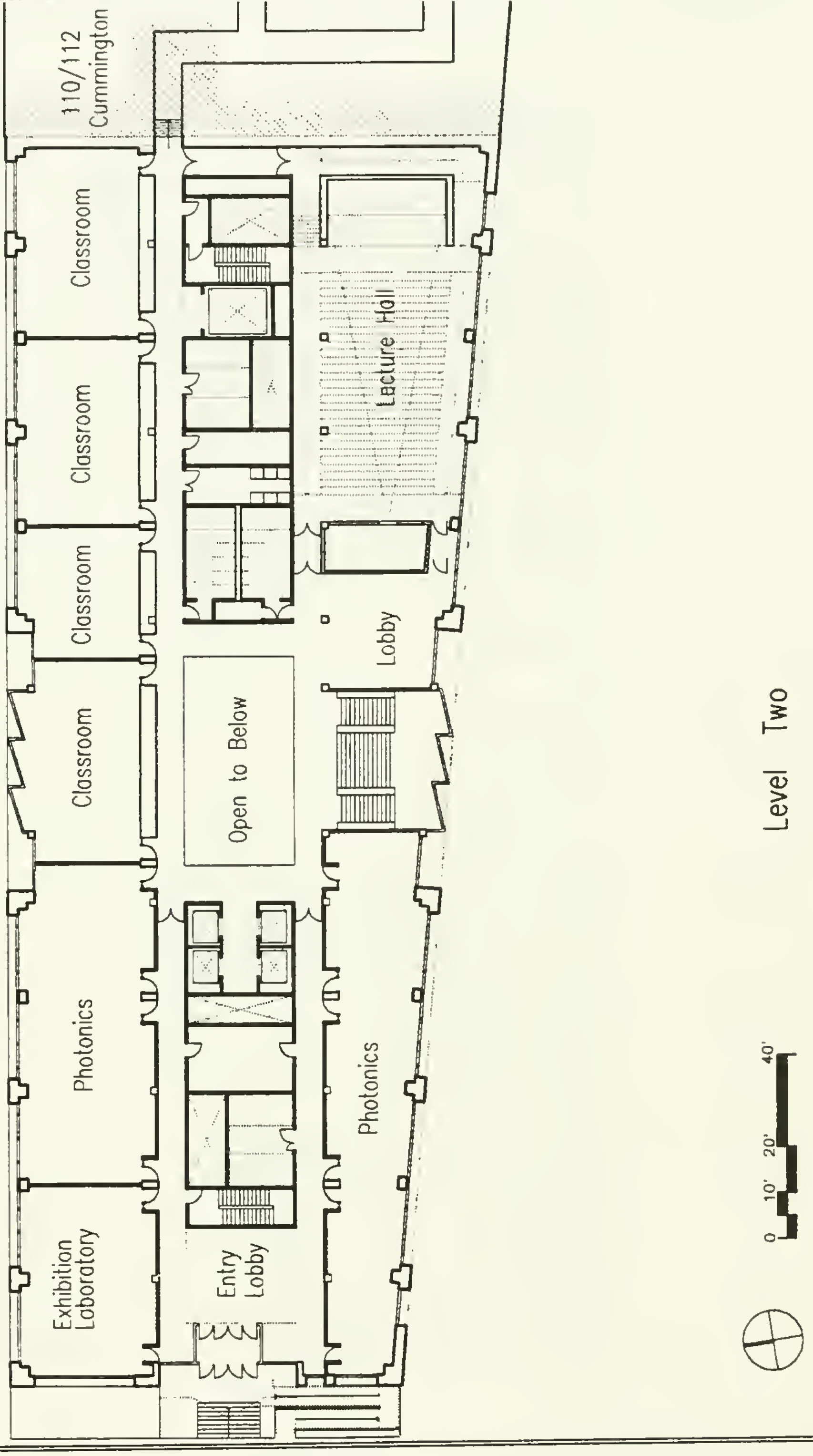
The Project seeks to respond to the following major factors:

- maximize the development potential of the site taking into account the University's long-term space needs within the limitations of the Project site;
- enhance and extend the science and engineering complex and promote the important research activities in the complex;
- take advantage of the site location as a gateway to the campus from the south; and
- strengthen the urban fabric of the campus and area in which it is located.



First Floor Plan
Babbitt Street Entrance

Prepared By: Cannon	**Figure 2-6**

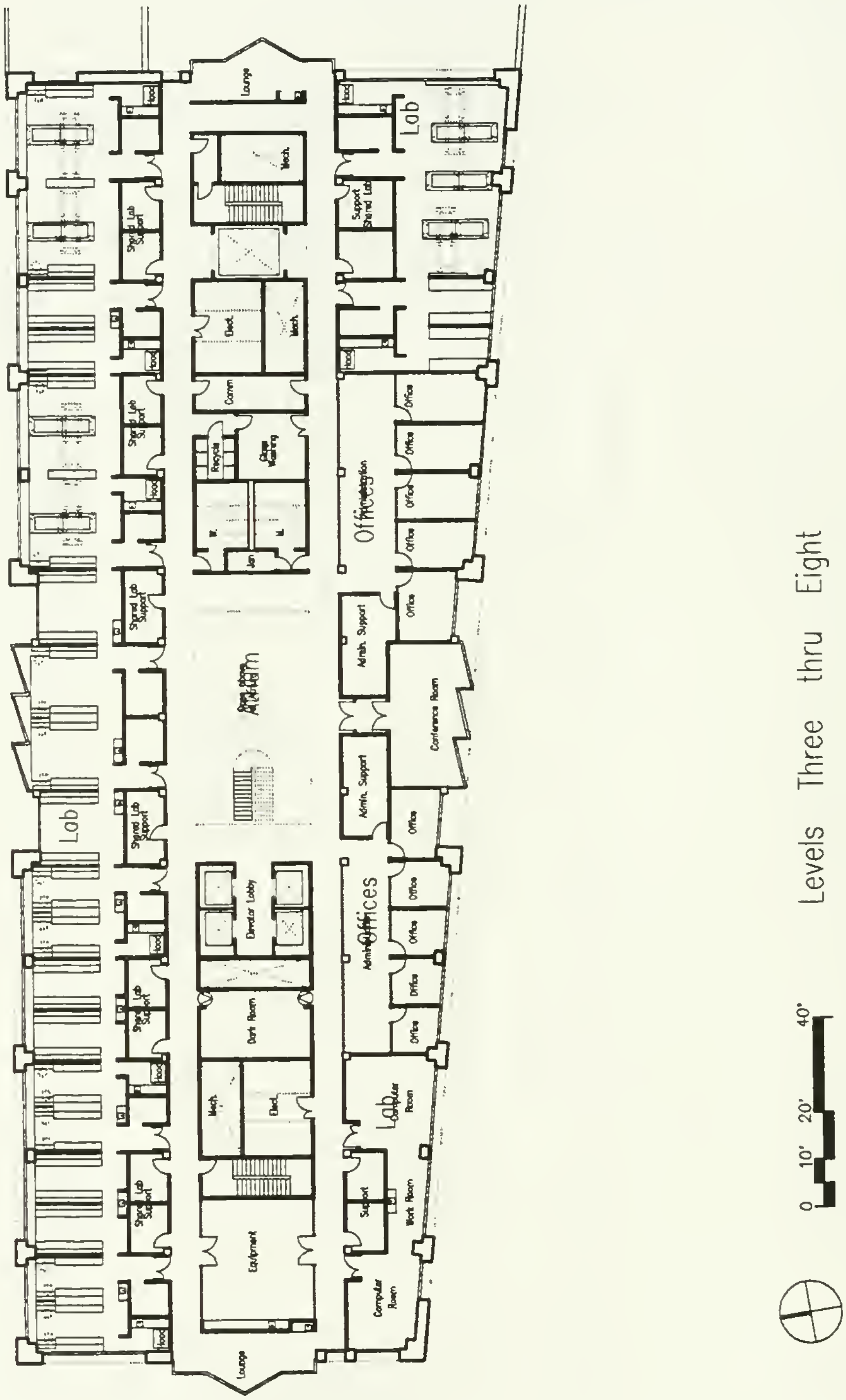


Second Floor Plan

St. Mary's Street Entrance

Prepared By:
Cannon

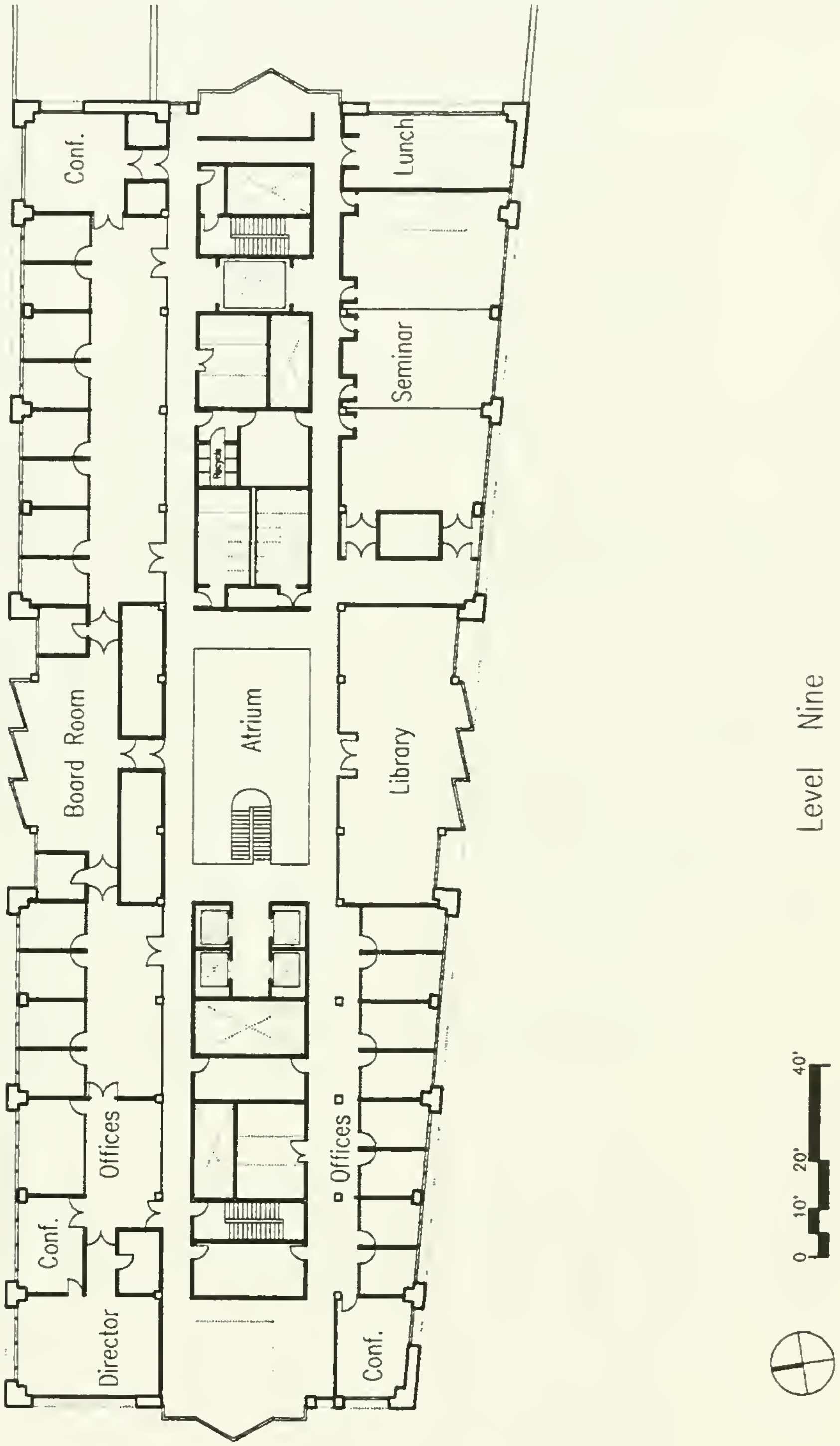
Figure 2-7



Typical Floor Plan

(Levels Three through Eight)

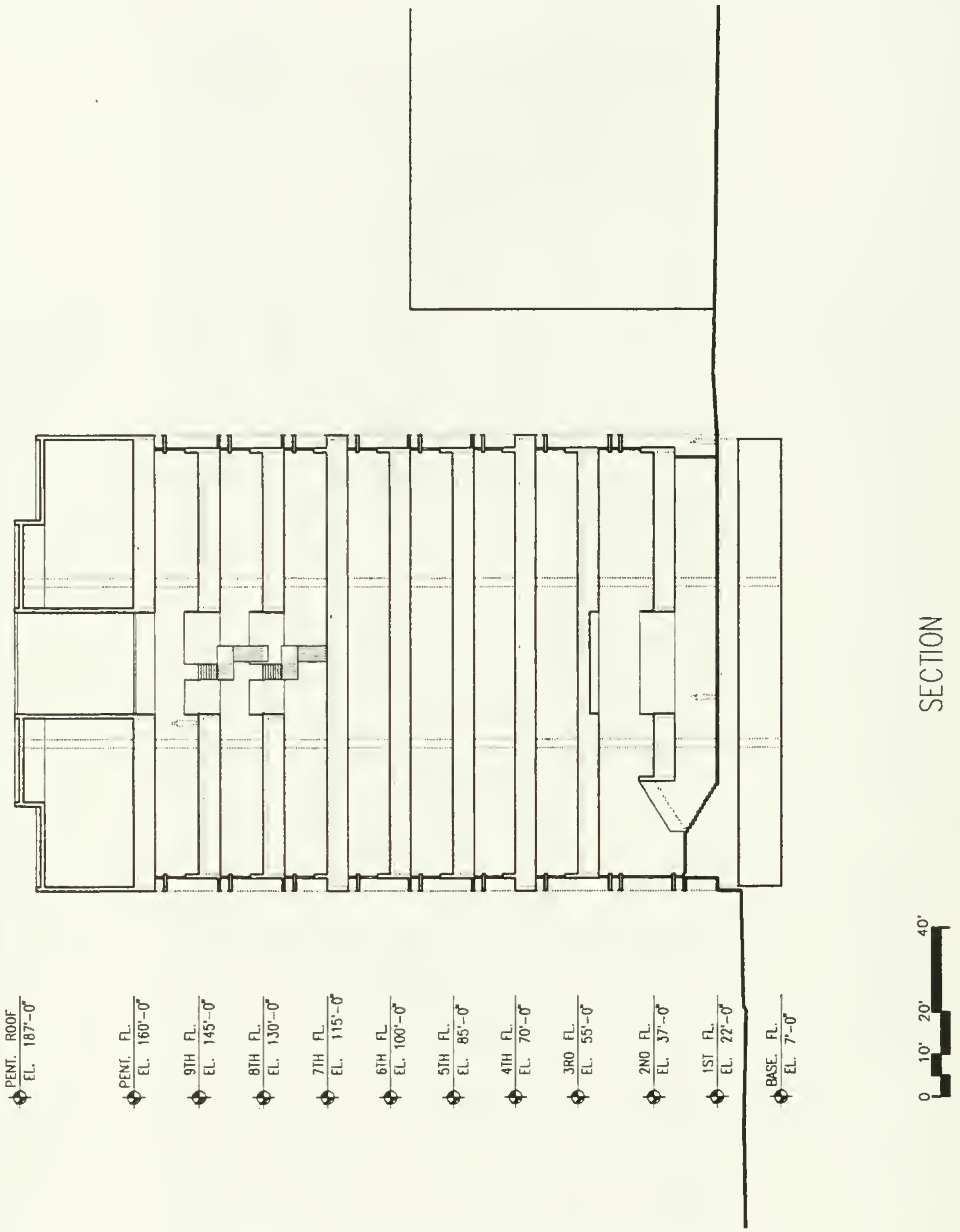
Prepared By: Cannon	**Figure 2-8**



Ninth Floor Plan

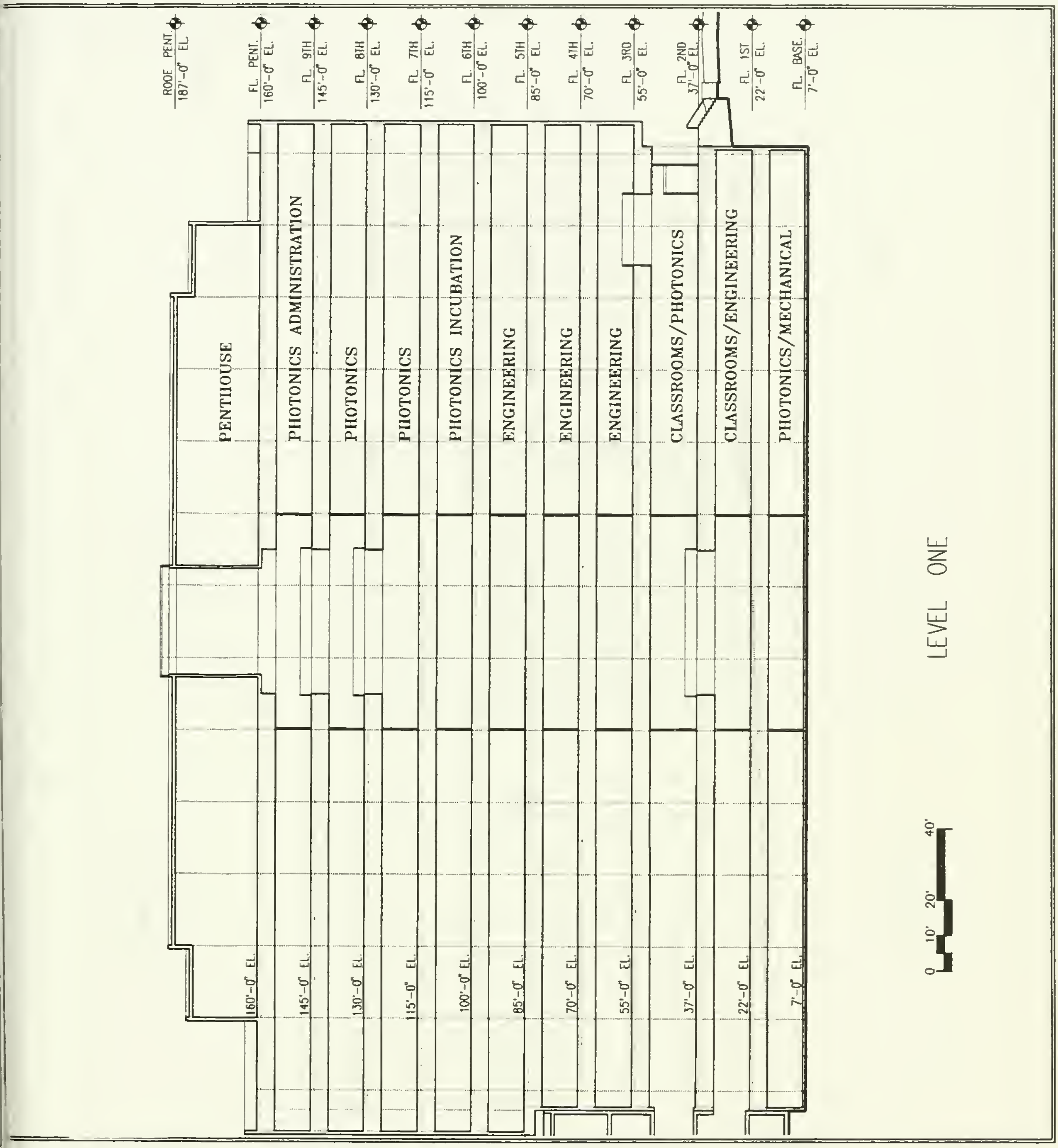
'repared By:
Cannon

Figure 2-9



North/South Section

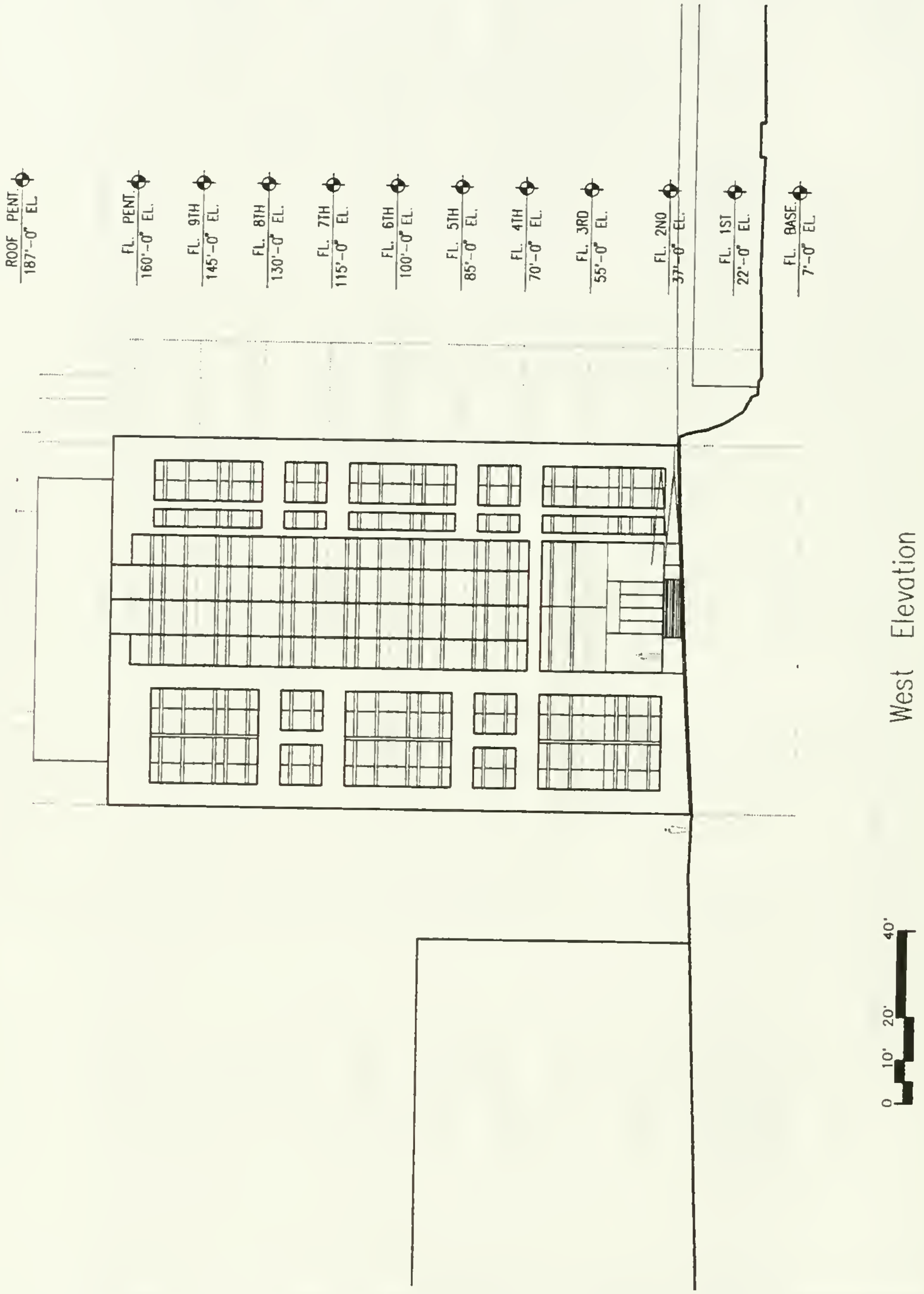
Prepared By: Cannon	**Figure 2-10**



East/West Section

Prepared By:
Cannon

Figure 2-11

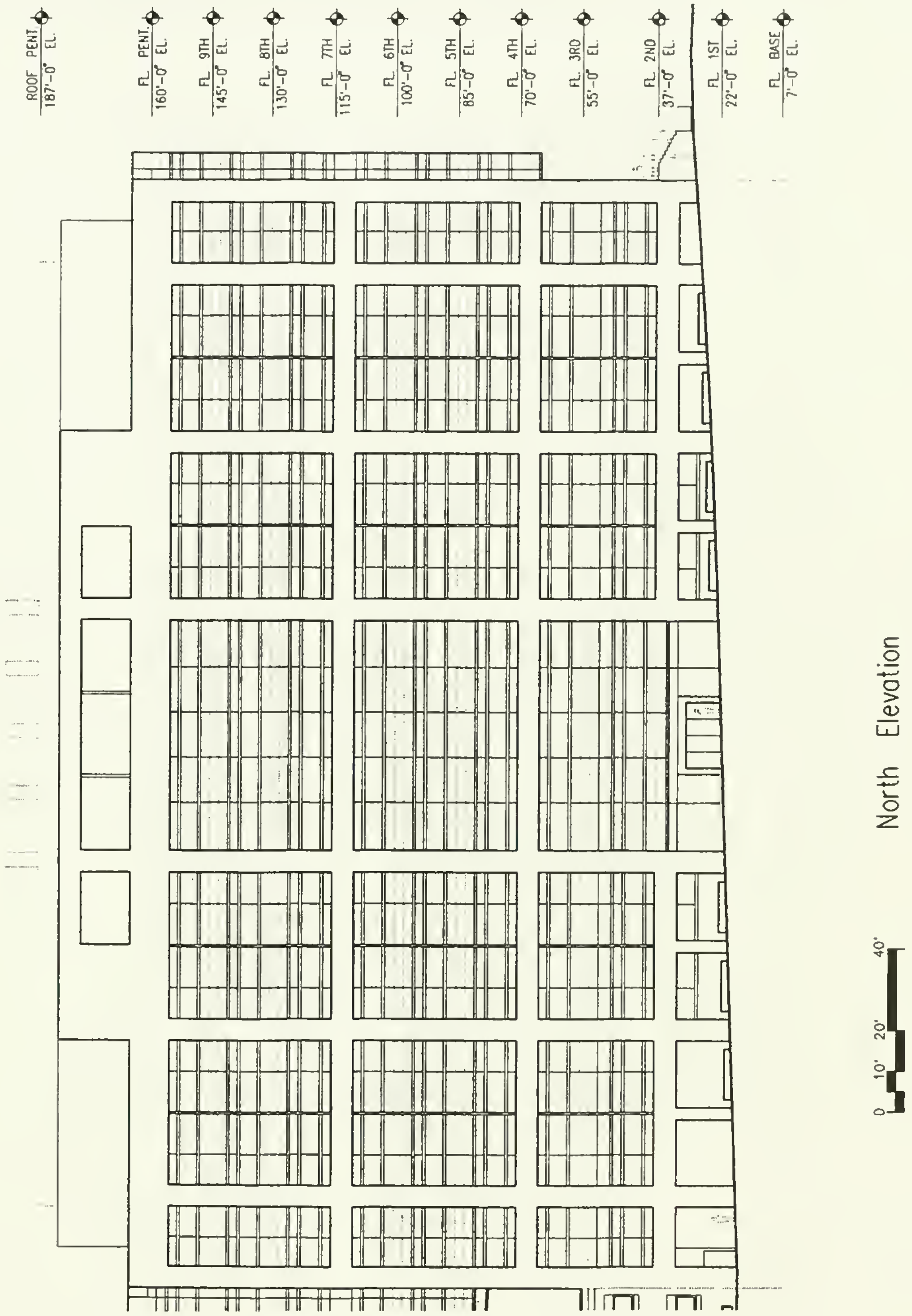


West Building Elevation

Prepared By:

Cannon

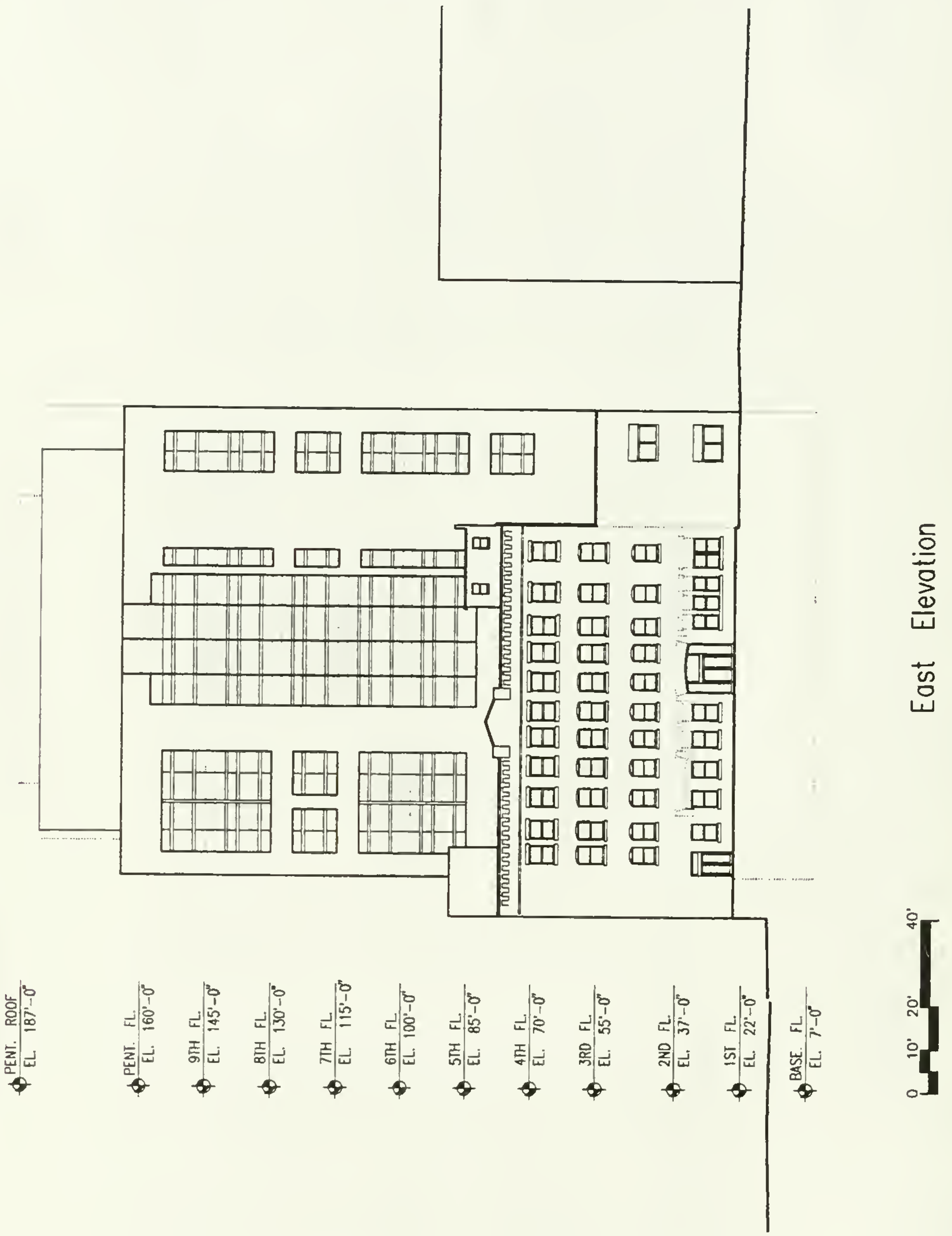
Figure 2-12



North Building Elevation

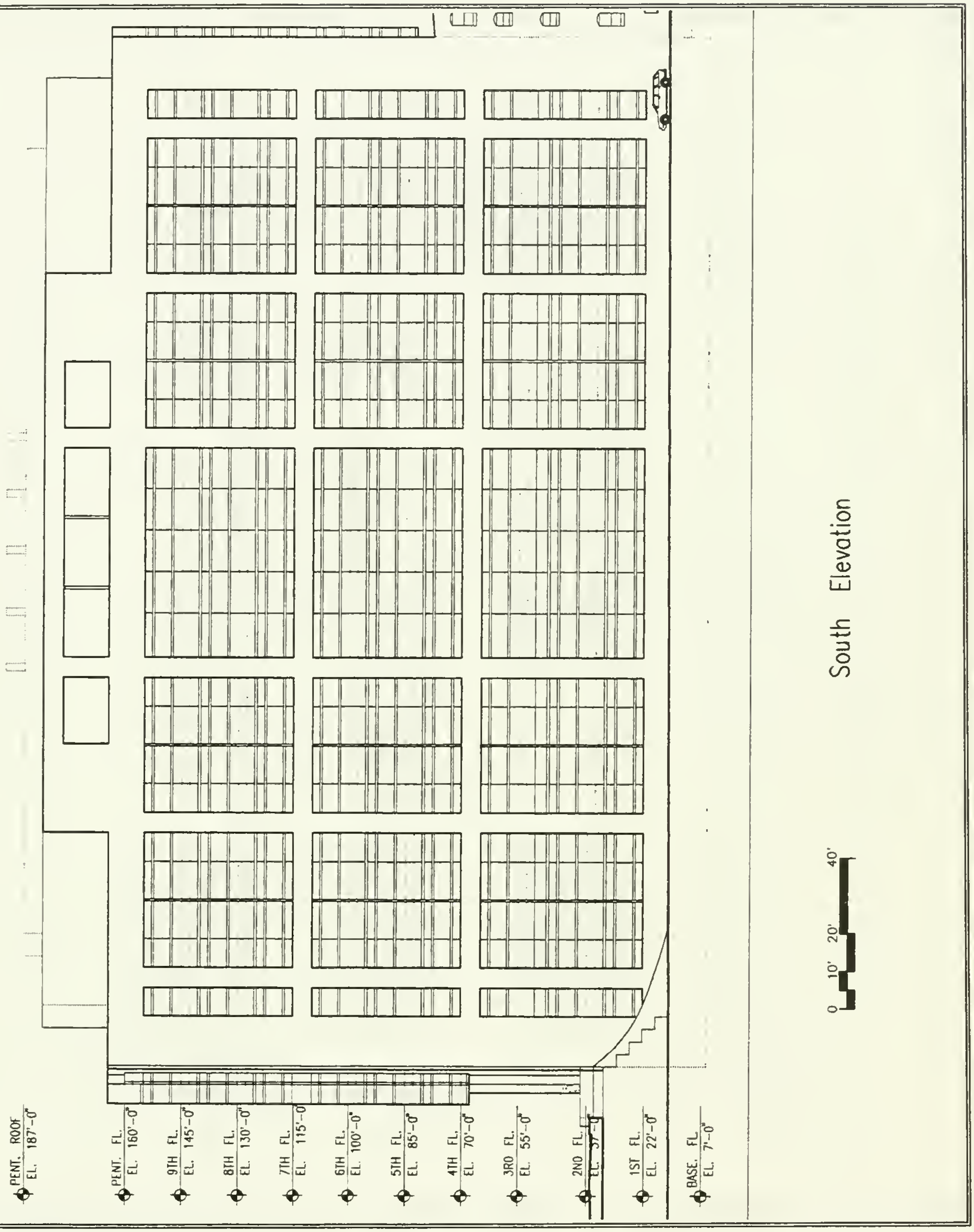
Prepared By:
Cannon

Figure 2-13



East Building Elevation

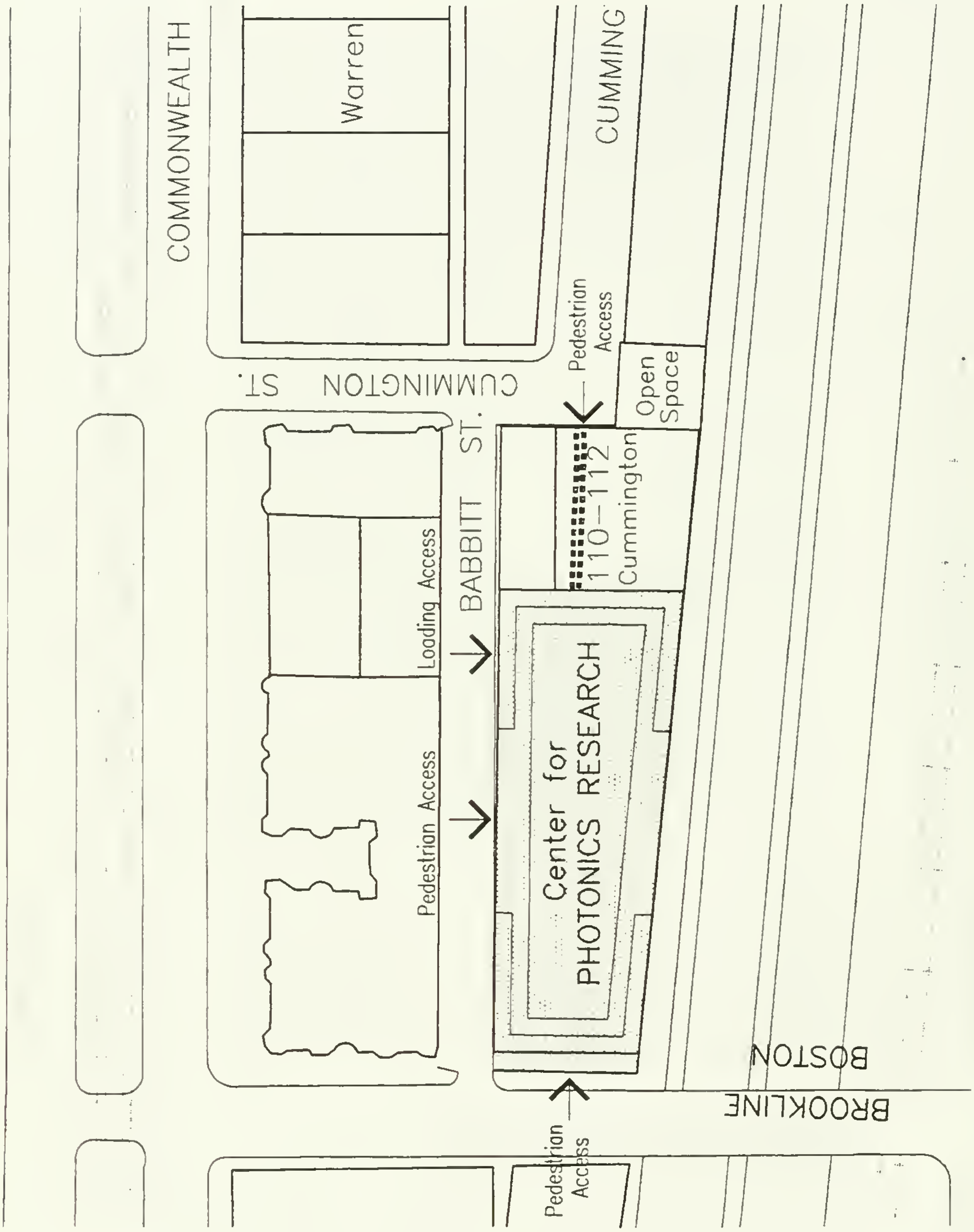
Prepared By: Cannon	***Figure 2-14***



South Building Elevation

'repared By:
Cannon

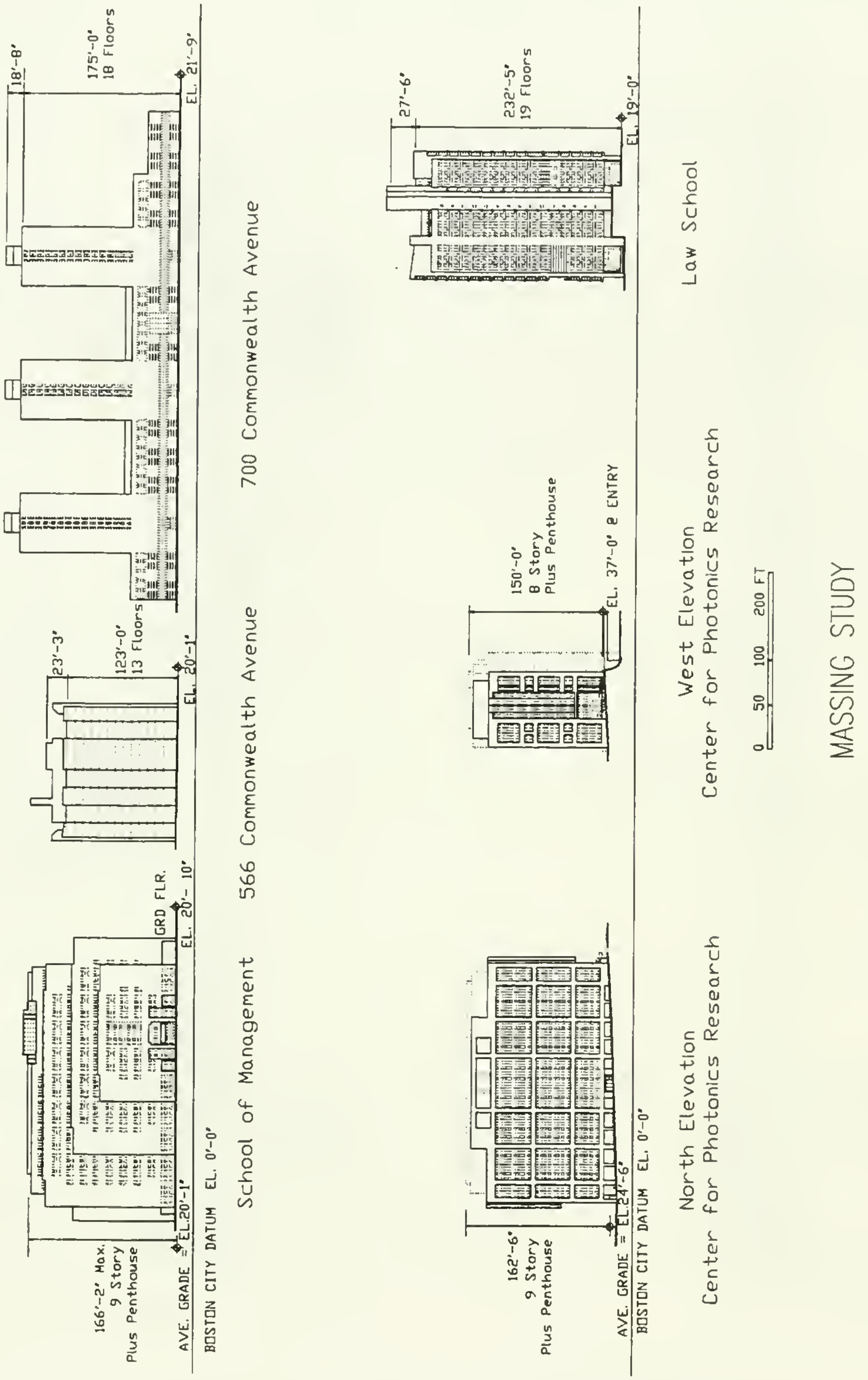
Figure 2-15



Site Access

Prepared By:
Cannon

Figure 2-16



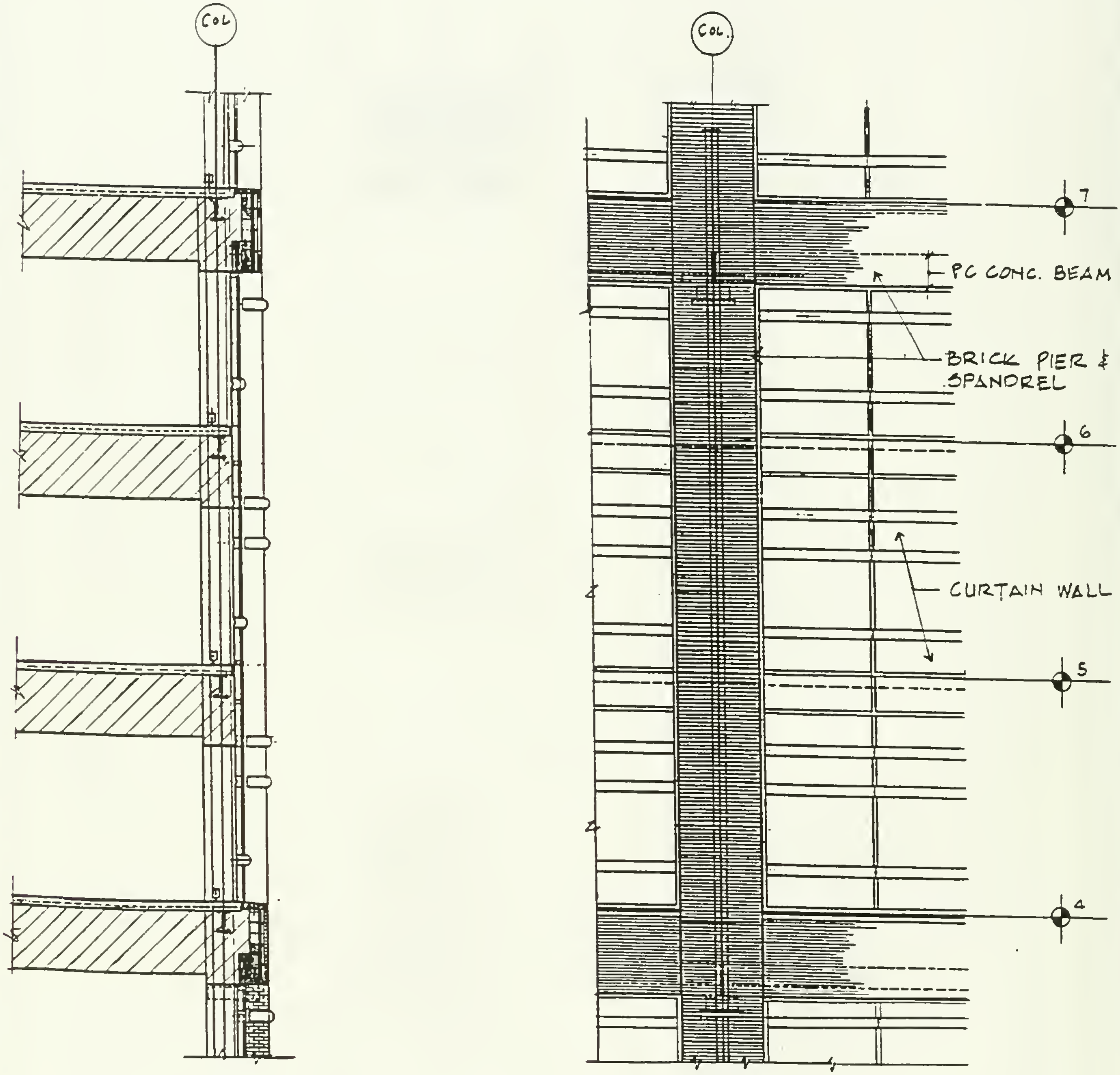
NOTE: HEIGHTS GIVEN ARE FROM ACTUAL OR APPROXIMATE GRADES PER PRESENT ZONING DEFINITION TO TOP OF ROOF STRUCTURE.

Massing Study

repared By:

Cannon

Figure 2-17



TYPICAL SECTION

PARTIAL WINDOW ELEVATION

Exterior Facade Detail

Prepared By:
Cannon

Figure 2-18

2.6.1 URBAN FABRIC

The design of the Research Center reflects the characteristics of its surroundings and also strengthens the fabric of the Charles River campus and enhances the science and engineering complex.

The urban fabric of the Project area contains several elements which impact the Project and Project site. The bordering uses of the site are radically different. One side is bordered by the Massachusetts Turnpike, a major interstate highway. This side offers dramatic views of the Project but also presents restrictions to the development of the site. One side is bordered by St. Mary's Street, a local street which connects to a residential and commercial area across the Turnpike. This corridor also provides a significant visual opportunity of the Project from the south although the street currently is one-way away from the campus. St. Mary's Street and utilities in the easement along the Project site present significant restrictions on site development along that border.

Babbitt Street is basically an alley behind the buildings which face Commonwealth Avenue. From Commonwealth Avenue, the Project is largely obscured by these buildings which back on to Babbitt Street between the site and Commonwealth Avenue. Therefore, the Research Center site does not directly relate to Commonwealth Avenue and the mixed use of activities which occur along this corridor. The eastern side of the Project site faces the University's science and engineering complex. The view opportunities of the Project from this side are generally contained within the complex. The Project serves as a natural extension of the complex and the Research Center shares mutual activities.

2.6.2 HEIGHT AND MASSING

The height and massing of the Research Center reflect the need to maximize the use of the Project site and achieve the University program requirements without dominating views from the surrounding area. While the Research Center is a prominent building in the science and engineering complex, it will fit in with other prominent buildings on campus such as the Warren Towers (700 Commonwealth Avenue), the Boston University Law School (765 Commonwealth Avenue), and the new Boston University School of Management (595 Commonwealth Avenue). The Research Center massing is also similar to other newer buildings in the science and engineering complex such as the Metcalf Science Center (590 Commonwealth Avenue) and the College of Engineering (44 Cummington Street). A massing study is provided in Figure 2-17.

2.6.3 FACADE TREATMENT

The exterior treatment of the Research Center reflects several goals. On the one hand, the building reinforces recent architectural style on the campus employing brick as the major building material. On the other hand, the building presents a different use of glass and metal which imply the unique research activities within.

The use of a neutral grid enlarged in a mannerist motif is employed to minimize the massing impacts of the building. The building wall is broken up with the use of recessed windows with metal sun shades. A vertical bay window element is employed on the east and west facades adding a lighter element to the building profile.

The facade design also employs axial and figural symmetry elements in the glass windows above the building entry points which focus attention on these new entrances on Babbitt and St. Mary's Streets.

2.6.4 VISUAL IMPACT

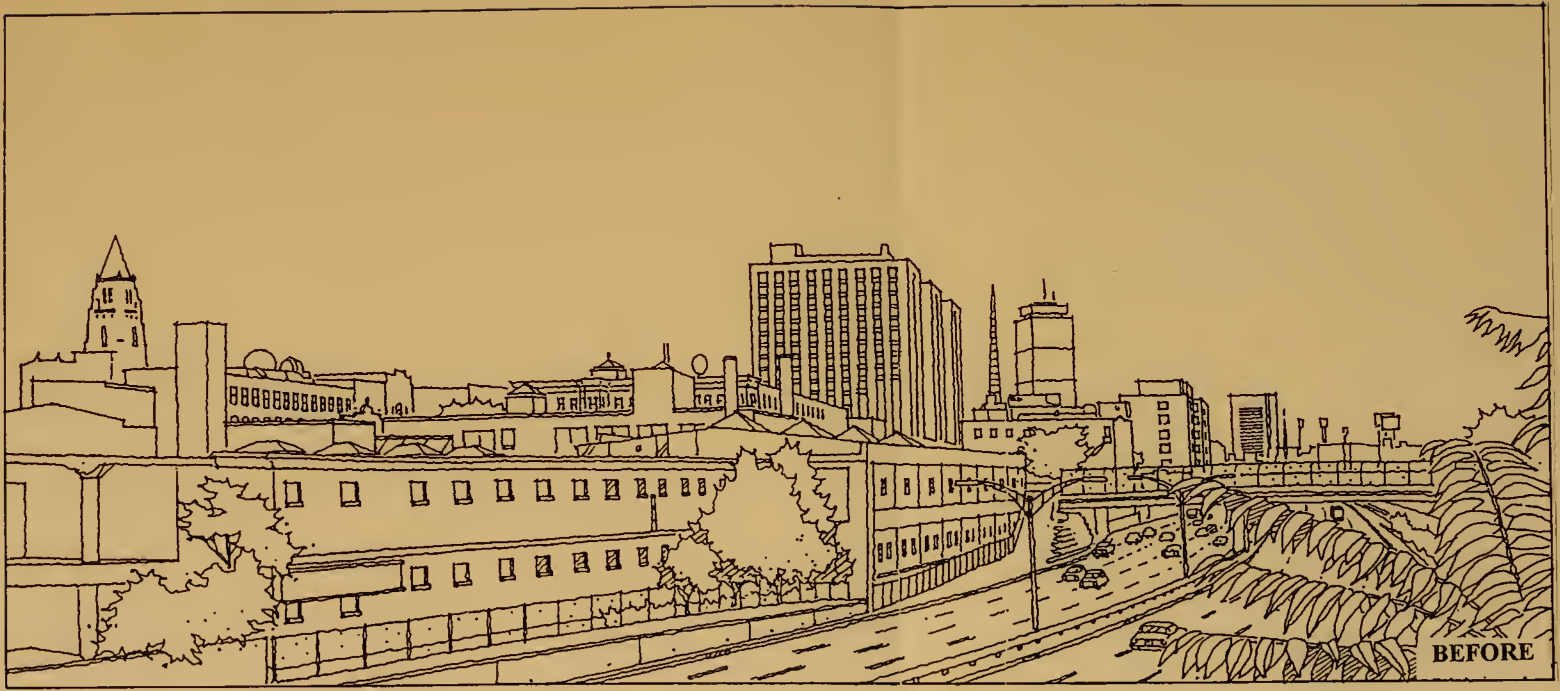
The Center for Photonics Research project will create a positive visual impact in the area by replacing unsightly and non-descript buildings with an attractive and unique building. Dramatic views of the building will be found from St. Mary's Street and the Turnpike. The new building will not figure as prominently in the urban landscape along Commonwealth Avenue. The building will present a notable, but not domineering, terminus to the west end of the science and engineering complex along Cummington Street. Selected before and after views of the Project are presented in Figure 2-19 through 2-23.

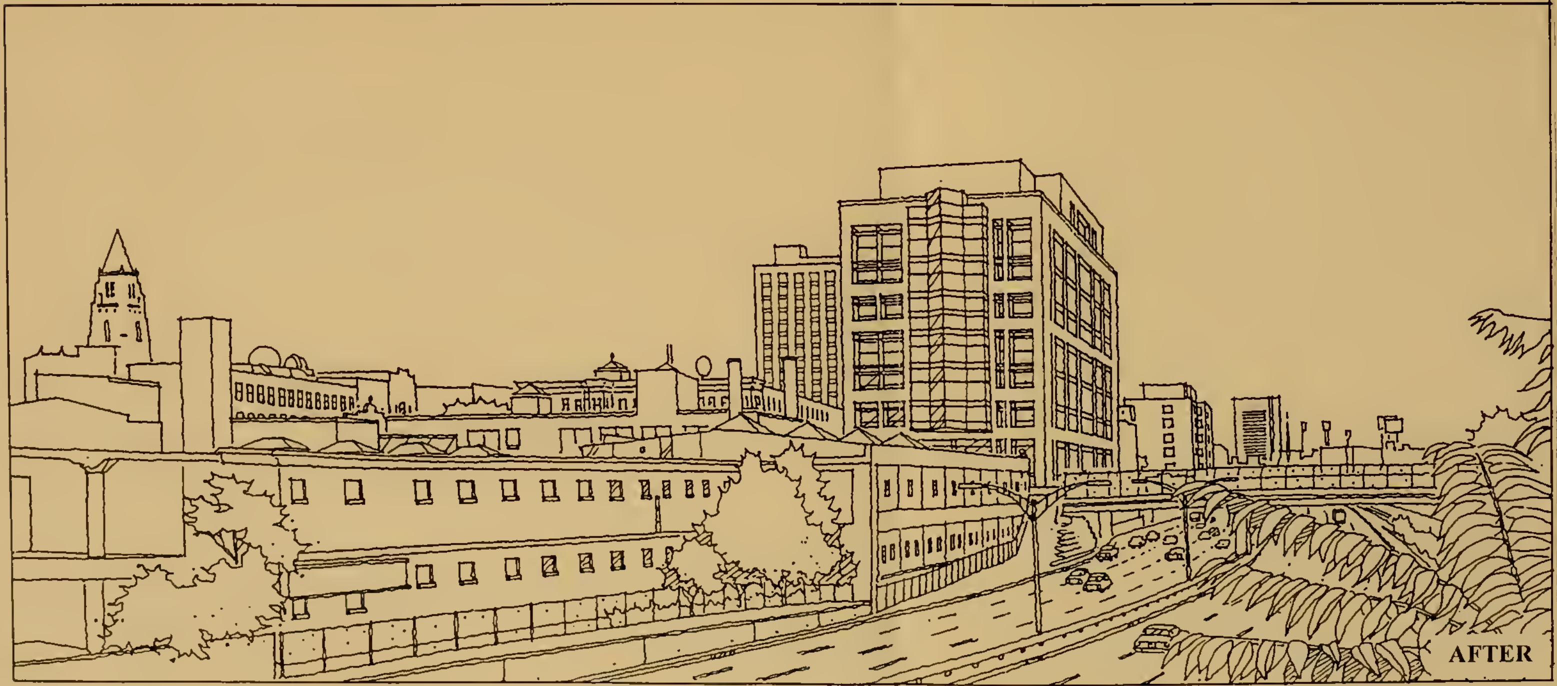
2.6.5 STREETSCAPE

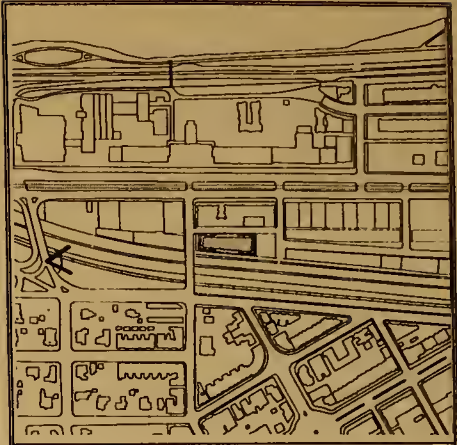
The entrances to the Research Center have been placed at the most logical points of entry given the site characteristics, internal uses and floor layout of the building on the first and second floors. Areas around the pedestrian entrances are expanded to contribute to the sense of arrival and to respond to the greater level of pedestrian activity expected. The walkways to building entries will employ brick paving materials. There will be building-mounted light fixtures along Babbitt Street and at the entrances. Babbitt Street lights will have shields to avoid impacts on adjacent residences. To the extent possible, landscaping will be included marking the Babbitt Street and St. Mary's Street entrances.

Babbitt Street will be significantly upgraded as a result of the Project. The whole street will be regraded and resurfaced. Pedestrian walkways will employ brick and feature strips to distinguish a safe path. Pre-cast pavers are contemplated for the remaining street surface.

The existing open space on site at the corner of Cummington Street is a small but important space in the science complex. The trees on the open space will be maintained. After construction of benches, landscaping and bike racks, open space will be enhanced as part of the Project.







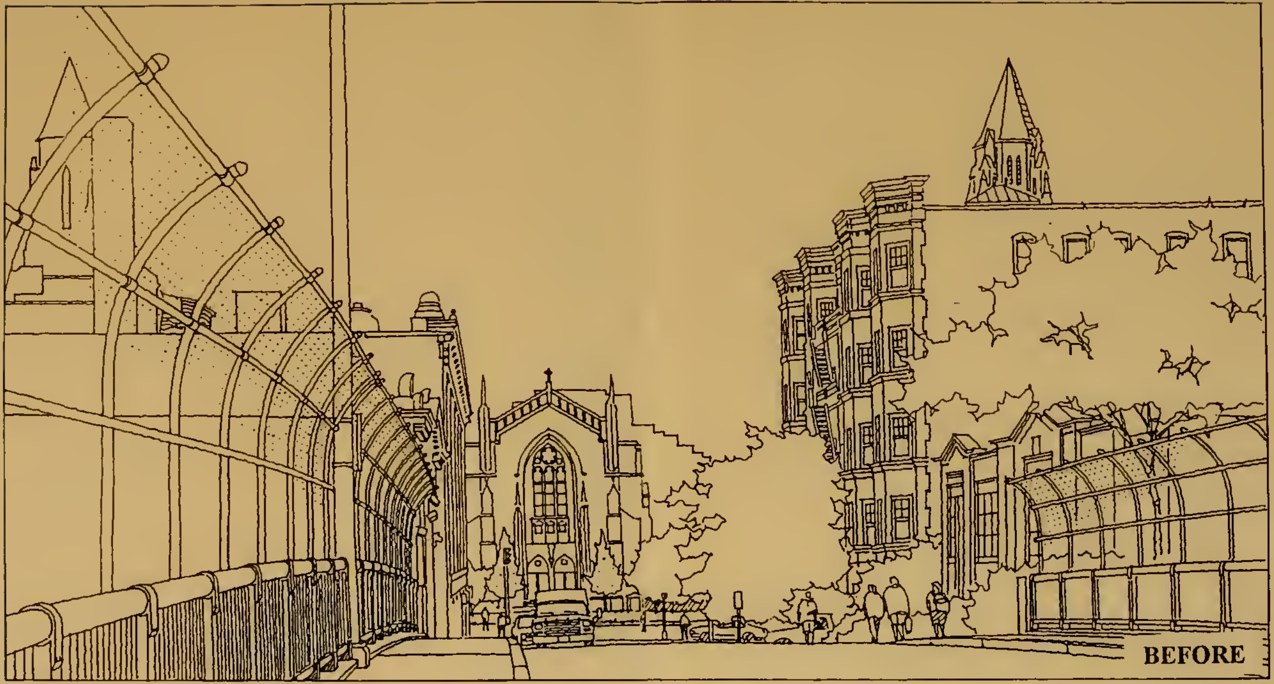
BOSTON UNIVERSITY

Center for Photonics Research

Carlton Street Looking Northeast

Figure 2-19

Prepared By:
Cannon
August 1994



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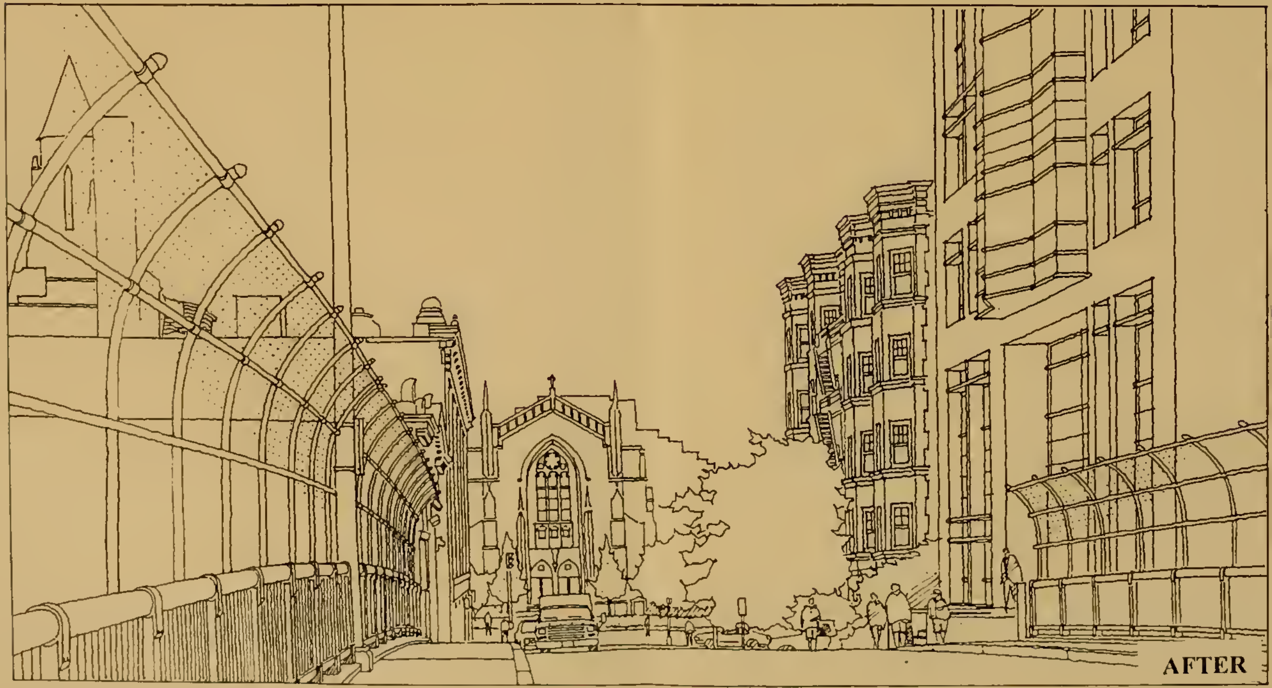

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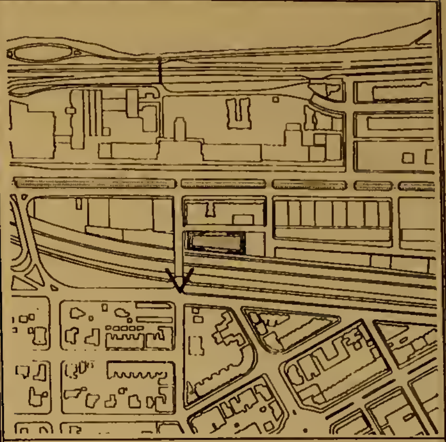


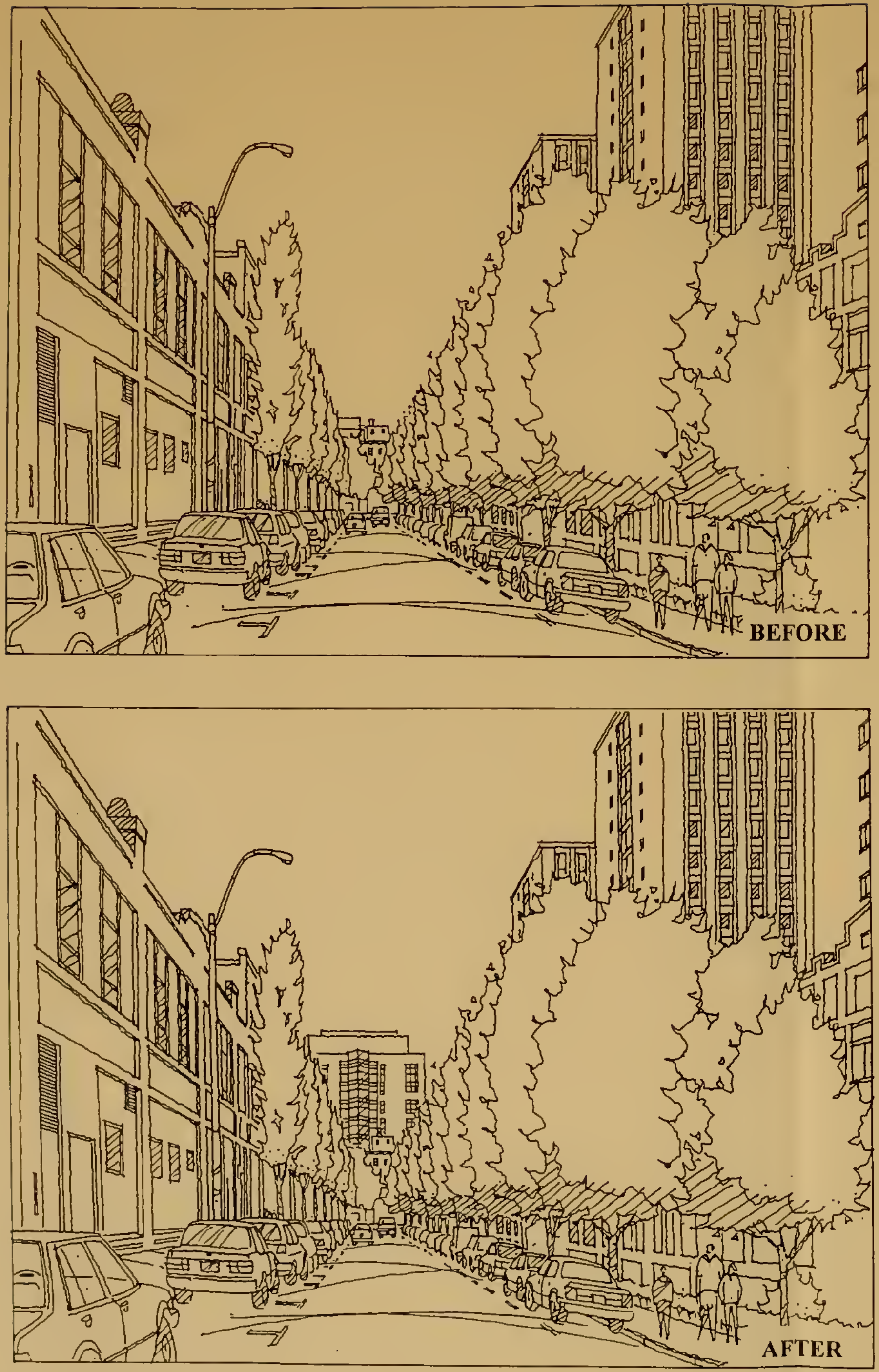
BOSTON UNIVERSITY

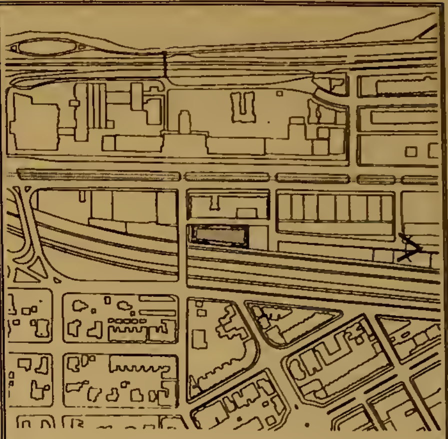
Center for Photonics Research

St. Mary's Street Looking North

Figure 2-20

Prepared By:
Cannon
August 1994





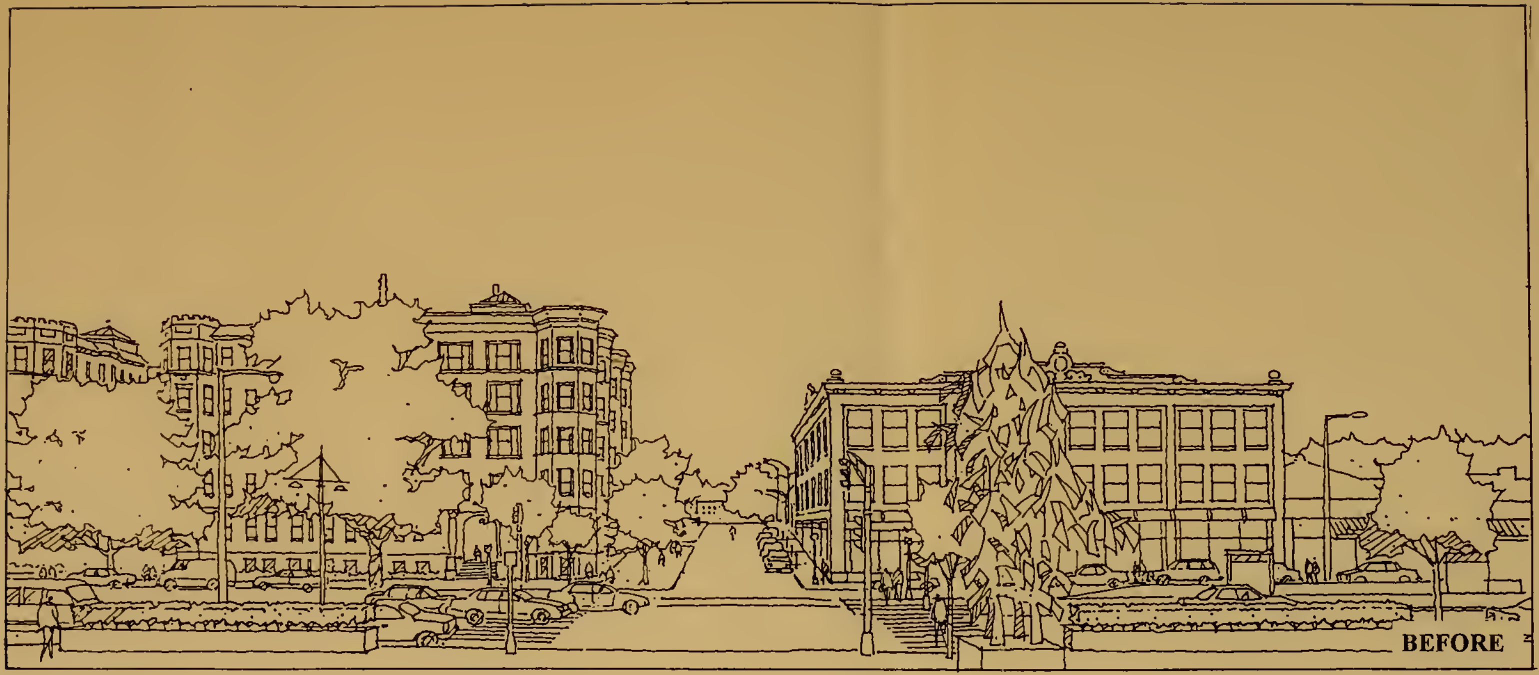
BOSTON UNIVERSITY

Center for Photonics Research

Cummington Street Looking West

Figure 2-21

Prepared By:
Cannon
August 1994



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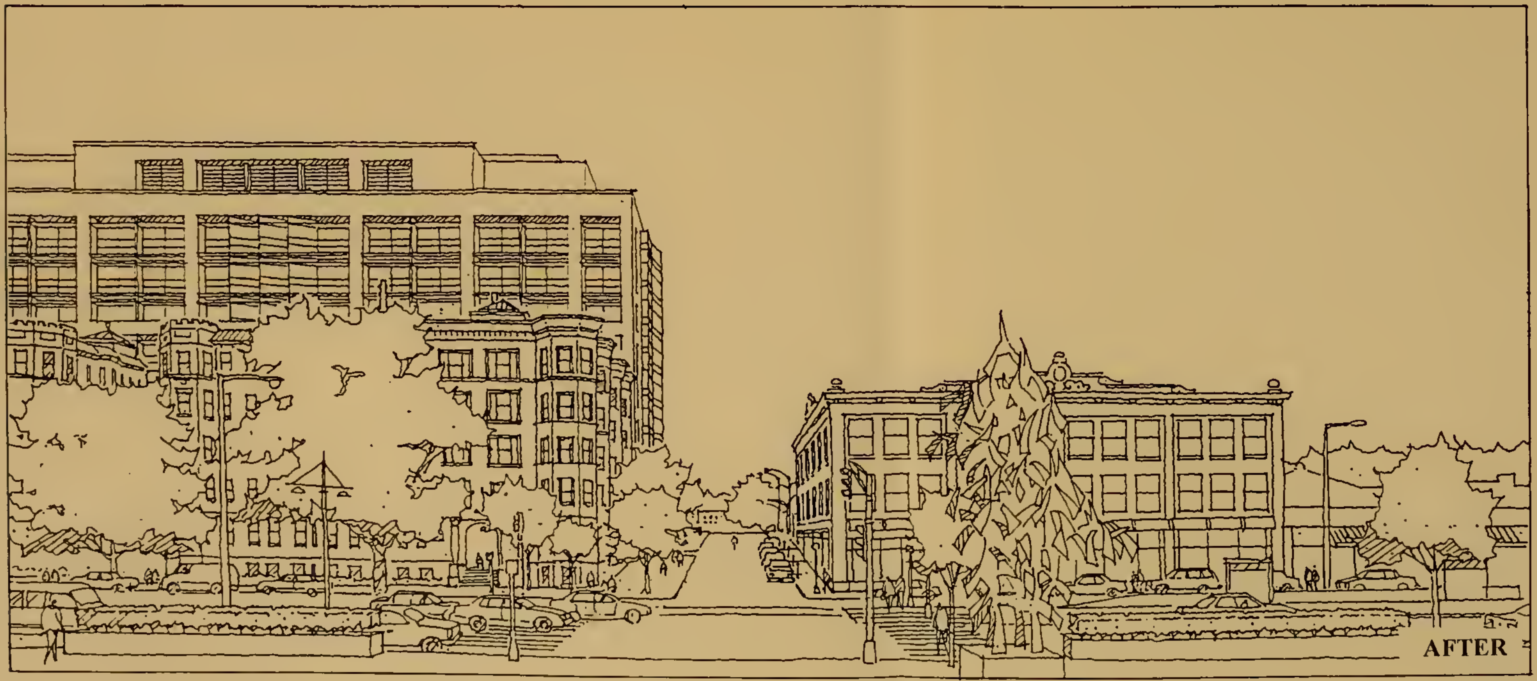

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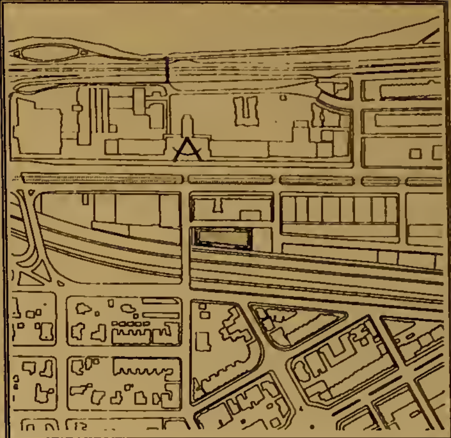


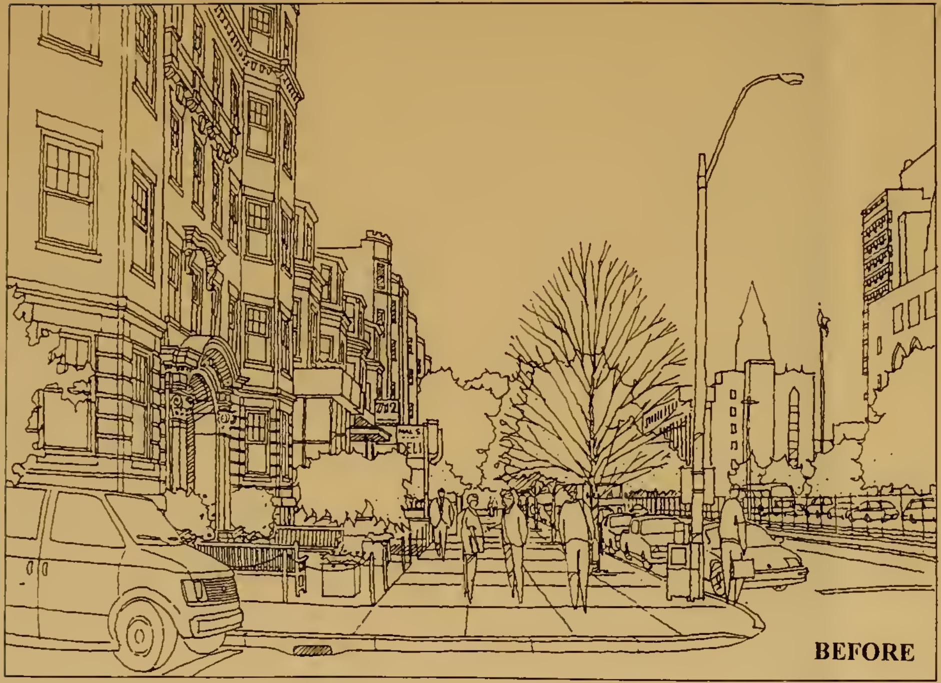
BOSTON UNIVERSITY

Center for Photonics Research

Front Steps of Marsh Chapel Looking South

Figure 2-22

Prepared By:
Cannon
August 1994



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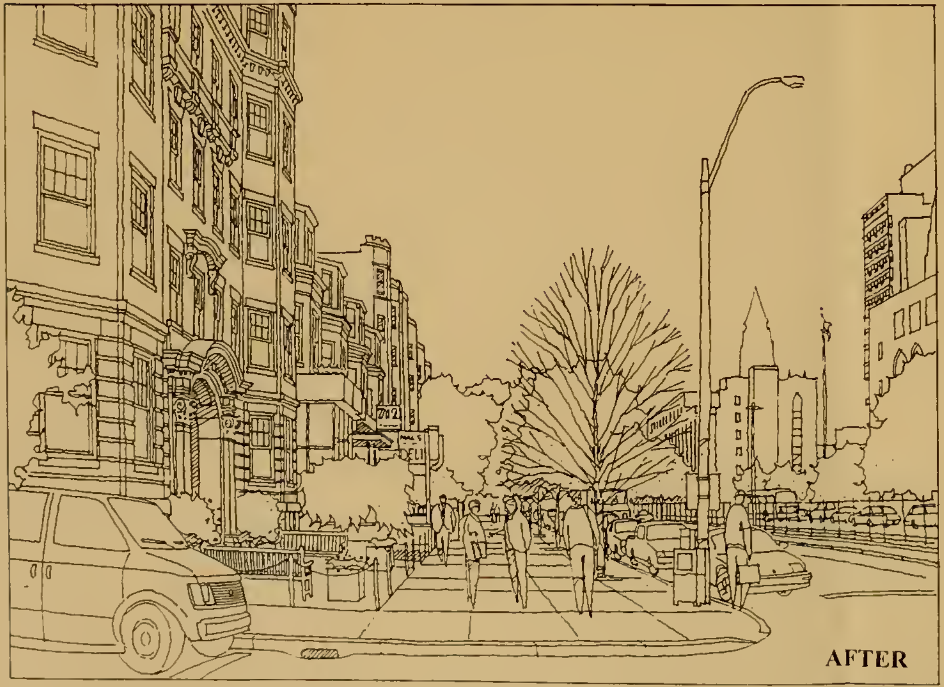

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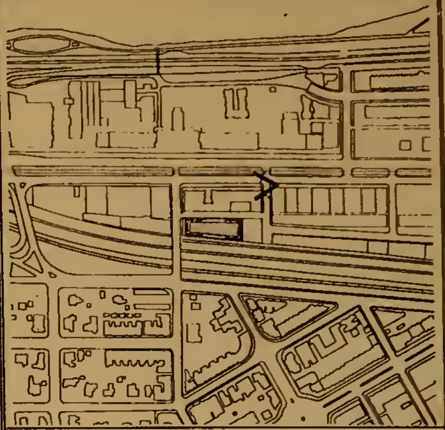


BOSTON UNIVERSITY

Center for Photonics Research

Commonwealth Avenue Looking West (from South side)

Figure 2-23

Prepared By:
Cannon

August 1994

2.7 COMMUNITY BENEFITS

2.7.1 GENERAL BENEFITS

For over a century, Boston University has been an integral part of the City of Boston. Committed to an urban campus, the University has consistently grown and contributed to the character and identity of the city and served as a prominent economic stabilizing force. The University's national and international prestige significantly strengthens the City of Boston's national and international reputation. For example, in 1989, both President Bush and President Mitterand spoke at the University's commencement. In addition to being a significant employer in Boston, the University contributes to the well-being of the city and provides direct services to local community residences and businesses.

Economic and Employment Benefits

Benefits from Boston University which contribute to the Boston economy include employment, property taxes, federal grants, and acquisition of goods and services by the students, faculty and the administrative population. In fiscal year 1992, the University, its affiliates, and students expended over $710 million. Of this amount, $558.8 million was spent in direct expenditures within the Commonwealth of Massachusetts. In addition, an estimated $641.2 million in indirect expenditures was generated (based on economic factors from the U.S. Department of Commerce, Bureau of Economic Analysis), resulting in a total impact of $1.2 billion in 1992 alone.

In 1992, Boston University directly employed over 21,500 people and indirectly created approximately 11,500 jobs, providing a total employment impact of close to 33,000 jobs. It was estimated that students alone brought in an additional $129.7 million related to living expenses. The total direct and indirect economic impact from the University in 1992 was estimated to be $396.2 million in the City of Boston.

In the 1992 fiscal year, Boston University employed approximately 2,900 Boston residents who earned more than $58 million in salaries and wages. They used more than 4,500 city vendors of goods and services with direct expenditures of more than $70 million. Student expenditures in the City of Boston totaled over $74 million.

Municipal Services

As a major urban institution in the City of Boston, Boston University takes the responsibility of providing and augmenting major municipal services in and around its campus. It employs its own police and security forces 365 days a year, 24 hours per day to patrol the campus and surrounding neighborhoods. University police forces are also available for on-call back-up assistance to Boston Police, Brookline Police and State Police as necessary. They also assist the City of Boston in the issuance of parking tickets, which raised approximately $50,000 in 1992.

The Boston University Physical Plant provides a variety of daily maintenance activities around campus. These activities include maintenance of sidewalks, streets, and MBTA platforms serving the campus. They also provide and maintain landscaping and perform rubbish and snow removal services. In 1992, these services were provided at a cost of over $600,000. Rubbish removal services are provided for private rental housing properties in addition to properties owned and occupied by the University.

Scholarship Programs and Grants

The University annually provides hundreds of scholarships to residents of the Greater Boston community. The Boston Scholarship Program awards 58 full, four year scholarships to Boston High School graduates every year. This program, which is 20 years old, is the largest program of its kind in the United States. In 1992, over 350 scholarships worth close to $5 million were awarded to Boston public high school graduates, Boston city employees, Boston public school teachers, Boston parochial school graduates, graduates of Bunker Hill and Roxbury Community Colleges, and families of fire fighters killed in the line of duty. Over the past ten years, almost $1 million in aid has been designated for City of Boston employees. The cumulative value of such scholarships since 1981 is over $33 million. In addition, the University provides scholarships to residents of Chelsea and Brookline.

Boston University cultivates a significant amount of federal research dollars, student loans, and donations from outside the state. In the 1991-1992 academic year, the University brought approximately $220 million to Boston in tuition and fees from outside the state. It also won $60 million in federal research funding and brought in $37.2 million in donations, $31.5 million of which were from outside the state. Student loan activity associated with Boston University totaled almost $35 million in the 1991-1992 academic year.

2.7.2 PROJECT BENEFITS

The new Center for Photonics Research project is subject to Article 26A and 26B of the Boston Zoning Code which established linkage obligations for developers to off-set impacts of large scale development. Article 26A requires a payment toward low and moderate housing through the direct creation of housing or contribution to the Neighborhood Housing Trust. Similarly, Article 26B requires a contribution to the Neighborhood Jobs Trust for training of low and moderate income people, or creation of such jobs directly by the development. The Project will generate approximately $652,500 in housing linkage funds and approximately $130,500 in job linkage funds to the City of Boston. The Project creates the potential for 94 new jobs in the Research Center and 15 jobs in resulting vacated space on campus. Furthermore, the Project will create up to 250 construction jobs over a two year period.

In addition to these direct economic benefits, the new Center for Photonics Research project includes over $8 million in funding for new research over the initial three year period of the DOD grant which is expected to provide a basis for obtaining $8 to $10 million per year of additional research and development funding after completion of the new facility. Furthermore, the Project will create excellent "incubator" facilities to new companies including small and minority businesses. By creating these facilities in Boston, it is hoped that one or two new companies will be created each year based upon new products developed at the Research Center, hence establishing a new economic base in the City of Boston. It is hoped that these facilities will serve as a catalyst to establishing Boston as a market center for the $75 billion per year photonics industry.

The new Center for Photonics Research project will create other positive benefits to the neighborhood area with improvements to Babbitt Street. The Project will result in the revitalization of an unsightly and substandard alley adding to the vitality and safety of the areas bordering the site. The Project includes landscaped areas with a new level sidewalk, providing important pedestrian and traffic safety improvements along the Babbitt Street block. The new building is designed to provide pleasing views from the Massachusetts Turnpike and other viewpoints by replacing the three current buildings with a new attractive building.

2.8 PROJECT COST AND SCHEDULE

The new Center for Photonics Research project is estimated to cost approximately $75 million including the renovations associated with the building at 110-112 Cummington Street and Babbitt Street reconstruction. The Project is expected to begin in early 1995 with demolition of existing buildings. The construction is expected to be completed by the end of 1996.

3.0 MASTER PLAN AND ZONING CONSISTENCY

3.0 MASTER PLAN AND ZONING CONSISTENCY

3.1 INTRODUCTION

This chapter provides a discussion of the consistency of the Center for Photonics Research project in relation to the Boston University Charles River Campus Master Plan 1986-1996 and the existing City of Boston zoning classification. A discussion of reuse of vacated space associated with the Project is also provided.

3.2 MASTER PLAN

In 1980, Boston University entered into a Cooperation Agreement with the City of Boston which articulated the University's desire to consolidate the academic core of the Charles River Campus. The Agreement established a development plan and tax program for the campus area and defined a growth corridor for the campus. Following a series of discussions between the City and the University during 1984 and 1985, the University embarked on the preparation of a "Master Plan" which addressed housing, parking, academic facility, and athletic program needs based on student enrollment projections through 1995. This document was developed through a comprehensive process which involved the BRA and other City officials; University representatives; and the Boston University Task Force including community groups from Boston, Allston, Brighton, and Brookline. A major feature of this plan, published in February 1987 with the endorsement of the Task Force, was the identification of sites within the Charles River Campus which could accommodate identified needs of the University.

During the Master Plan development process, it was recognized by all parties that the existing zoning classification was inadequate, outdated, and would not accommodate academic activities or the density of development, nor does the existing zoning support other goals in the document such as containing development on campus. This was one of the reasons a Master Plan for the campus was developed -- to provide a useful tool for evaluating development. The Master Plan is not an inflexible tool or rigid program for the future; it is an advisory document which offers the University's vision and anticipated long-term needs while responding to neighborhood concerns and to City policies and goals for the area. It is a document which reflects a sharing of ideas and general consensus about what could happen between 1986-1996. At this time, it is anticipated that the Master Plan will be updated and renewed in 1996.

Objectives of the Master Plan

The relevant objectives of the Master Plan include the following:

- to create a unified campus with delineated areas for housing, academic and administrative uses;

- to consolidate uses located in various locations throughout campus into single locations and thereby maximize campus space and minimize the need to spread into other areas; and
- to recognize the impact of new development near the campus edge with a view to minimizing adverse impacts on adjacent uses.

The Project is located on Parcel K (8 St. Mary's Street) in combination with adjacent University property to the east which contain academic science and engineering facilities. Parcel K is identified in the Master Plan as a site for acquisition that would serve as a logical extension of the engineering complex. As a relatively small site, approximately 8,100 square feet, the master plan did not deal with Parcel K as a major potential development site. Parcel K may be seen on the Potential Site Map on the following page.

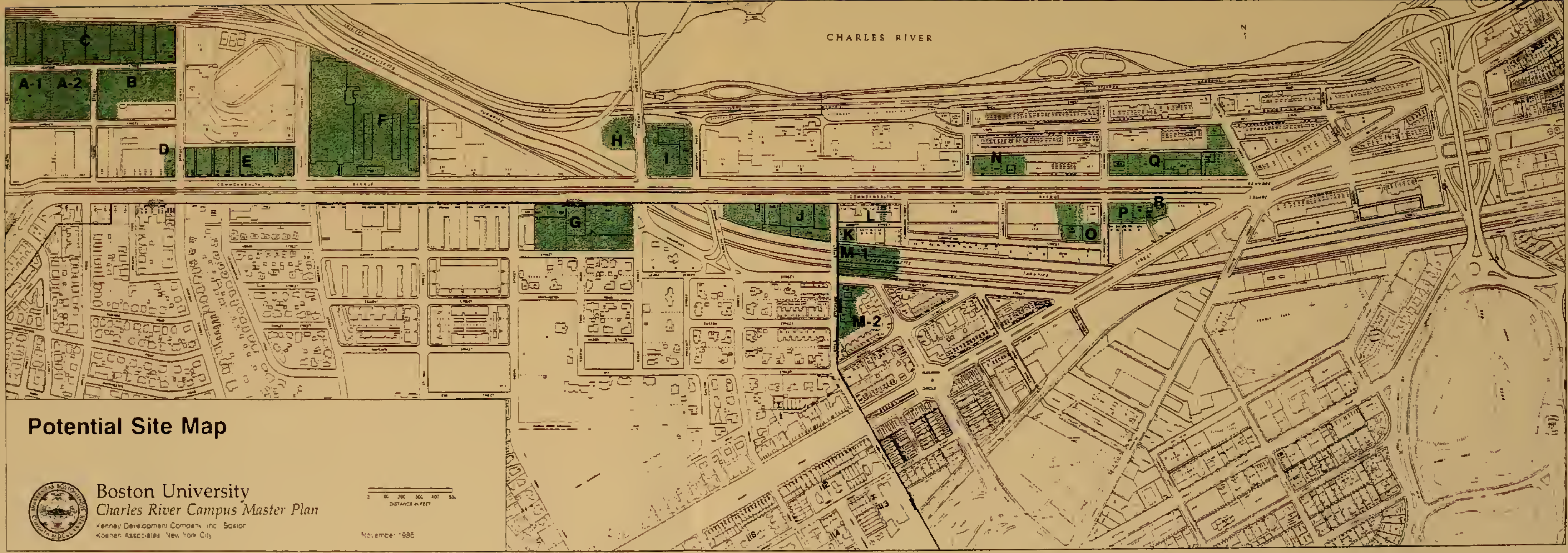
3.2.1 MASTER PLAN CONSISTENCY

Parcel K was contemplated for acquisition during the development of the Master Plan and was acquired in 1992. The Department of Defense (DOD) grant for development of a photonics research facility was awarded the following year. The best location for such a research facility is near other science activities. Therefore, locating the Project on Parcel K was a logical choice as it is complementary to other science and engineering activities and serves to extend the science complex as contemplated in the Master Plan. The Research Center program requires more space than provided on Parcel K alone and therefore needed to include adjacent University properties. The development of the Research Center presents an opportunity to upgrade existing academic facilities and also to integrate the photonics facilities with other science and engineering research activities. The result is the Project which includes upgraded academic facilities incorporated on the site with the new Center for Photonics Research facilities.

The Project is consistent with the Master Plan in that it enhances science and engineering facilities and extends the complex as envisioned. It is proposed that the Master Plan be amended to more accurately reflect the Project. The Project concept was presented the Boston University Task Force on April 12, 1994 and May 11, 1994. The Task Force voted to approve the Project concept and to amend the Master Plan accordingly.

In addition to Master Plan uses designated for the Project site, the Project size and design are intended to maximize use of the site. This to minimize impacts on adjacent neighborhoods by containing development within the existing campus area and also serves to achieve the objectives of the DOD grant, and upgrade academic facilities.

The Project is also consistent with the Master Plan in terms of the approvals process. The Master Plan indicates that for projects over an acre in size, it is appropriate to pursue a Planned Development Area (PDA) approval. The PDA processes was not specifically associated with Parcel K because of its small size. However, since the Project encompasses approximately an acre which includes Parcel K, pursuit of a PDA is an appropriate course of action and is consistent with other development projects on campus. Involvement of the Task Force and



Potential Site Map

Boston University
Charles River Campus Master Plan
Kenney Development Company, Inc. Boston
Koenen Associates New York City

November 1986

voluntary participation in the City's Article 31 process also are consistent with the review and approval processes discussed in the Master Plan and Cooperation Agreement.

3.2.2 REUSE OF VACATED SPACE

There will be some existing academic space on campus which will be relocated into the new building when the Project is completed in addition to the space replaced by demolition. Most of the programs contemplated for relocation are currently located within the science and engineering complex. At this time, it is contemplated that space in three locations will be vacated as a result of the Project:

Location	Assignable Square Footage
590 Commonwealth Avenue (Metcalf Science Center)	8,000
44 Cummington Street	7,500
143 Bay State Road	1,000
TOTAL	**16,500**

The space at 590 Commonwealth Avenue and 44 Cummington Street is comprised of office and engineering research laboratory space. The space in these two locations supports approximately 45 people including 10 faculty and 35 graduate and post doctorate students assisting in research. The faculty and students at 590 Commonwealth Avenue and 44 Cummington Street will be relocated into an engineering floor in the Research Center. It is anticipated that new faculty will be appointed and located in the vacated space. The supporting researchers, however, are typically hired from existing Boston University students. The space at 143 Bay State Road currently supports five photonics administration staff. These people will be relocated to the new headquarters in the Research Center. This vacated space will likely be replaced with new administrative personnel.

The vacated space associated with the Project will likely result in the addition of 10 new jobs in the science and engineering complex and five administration jobs at 143 Bay State Road.

3.3 ZONING CONSISTENCY

According to maps accompanying the Boston Zoning Code, the Project site is located in a M-2, or light manufacturing zone. The district is an isolated strip remaining after the establishment of the Massachusetts Turnpike reflecting the uses existing at the time zoning was imposed. The M-2 zoning district was applied to the Project site well before the establishment of the Charles River Campus as we know it. In recent years, the City of Boston has been systematically updating zoning classifications throughout the city and recently re-zoned the west end of the campus through the Allston-Brighton planning and zoning process. The BRA has indicated it is planning to focus on the east end of the Boston University campus in the near future. This outdated zoning conflicts with the Master Plan and the program needs of the University in several ways including academic uses, loading dock requirements, FAR, and setback requirements.

Colleges and universities granting degrees by authority of the Commonwealth of Massachusetts are conditional uses in M-2 zoning districts. The proponent will apply to the Boston Board of Appeal for exceptions to certain provisions of the Boston Zoning Code, including provision regarding use -- to allow university use and the accessory uses planned for the Project, and dimensional provisions regarding floor area, minimum rear yard depth, parapet setback, off-street loading, and signage.

3.4 CONCLUSION

The Boston University Center for Photonics Research project is generally consistent with the Boston University Master Plan for the Charles River campus. The Project concept has been approved by the Boston University Task Force, and as per the Task Force vote, the Master Plan will be amended to reflect the Project. The current zoning classification is outdated and inappropriate for University uses. It is not feasible for the University to pursue development as envisioned in the Master Plan without significant changes in the zoning classifications throughout campus. Therefore, the PDA being pursued for the Project is appropriate both in terms of the Project characteristics and the implementation process. The reuse of any vacated space as a result of the Project will be replaced with similar activities appropriate to the space type and location.

4.0 WIND

4.0 WIND

4.1 INTRODUCTION

A pedestrian-level wind study was conducted for the Boston University Center for Photonics Research Project. The objectives of this study were:

- to qualitatively assess the effect that the Center for Photonics Research building would have on No-Build and Build pedestrian-level wind conditions;
- to assess the predicted wind conditions in terms of the comfort criteria outlined by the Boston Redevelopment Authority (BRA); and
- to provide recommendations concerning mitigation measures for identified problem areas, if necessary.

The assessment was based on a review of the following information:

i. long term meteorological information obtained from Logan International Airport;

ii. site information in the form of aerial photographs;

iii. surrounding information obtained from the Boston Redevelopment Authority (BRA) and Cannon Architects;

iv. site and elevation plans of the proposed development issued by Cannon Architects;

v. flow visualization using smoke migration, and a limited evaluation of quantitative wind speeds, conducted with the aid of scale model tests in a boundary layer wind tunnel; and

vi. knowledge of the interaction of wind with buildings and topographic features.

4.2 OVERVIEW

Major buildings, especially those that protrude above their surroundings, often cause increased local wind speeds at the pedestrian level. Typically, wind speeds increase with elevation above the ground surface, and taller buildings intercept these faster winds and deflect them down to the pedestrian level. The funneling of wind through gaps between buildings and the acceleration of wind around corners of buildings may also cause increases in wind speed. Conversely, if a building is surrounded by others of equivalent height, it may be protected from the prevailing upper-level winds, resulting in no significant changes to the local pedestrian-level wind environment.

The consideration of wind in planning outdoor activity areas is important since high winds in an area tend to deter pedestrian use. For example, winds should be light or relatively light in areas where people would be sitting, such as outdoor cafes or playgrounds. For bus stops and other locations where people would be standing, somewhat higher winds can be tolerated. For frequently used sidewalks, where people are primarily walking, stronger winds are acceptable. For infrequently used areas, the wind comfort criteria can be relaxed even further. The actual effects of wind can change from pedestrian inconvenience, due to the blowing of dust and other loose material in a moderate breeze, to severe difficulty with walking due to the wind forces on the pedestrian.

4.3 METHODOLOGY

For this analysis of pedestrian-level wind conditions, the following alternatives were considered:

No-Build Condition - includes all existing surrounding buildings and no alterations to the existing development site, see Figure 4-1.

Build Condition - includes all existing surrounding buildings and the proposed Research Center building, see Figure 4-2.

The assessment was conducted with the aid of a 1:300 scale model of the proposed development and surroundings. The model was constructed on a circular disk and included construction of the surroundings within a 1100' radius of the development site.

The model was then placed in RWDI's boundary layer wind tunnel where flow visualization using smoke migration, and some quantitative evaluation using pedestrian level wind sensors (5' above grade at full scale) were conducted for 16 wind directions divided in 22.5 degree segments. A limited number of wind speed sensors were used in the wind tunnel tests to quantify wind speeds, in order to assess the relative differences in wind activity determined by the flow visualization tests.

4.4 METEOROLOGICAL DATA

Long-term meteorological data, recorded during the years 1945 to 1988 at Boston's Logan International Airport were analyzed to determine a correlation between wind speed and direction. For this study, hourly wind records for each of the four seasons and over the entire year were analyzed. These wind statistics, graphically presented in Figure 4-3 through Figure 4-5 as "wind roses", summarize the annual and seasonal conditions for wind speed, strength, and direction in the Boston area.

The first two wind roses in Figure 4-3 provide a summary of the spring (March, April, and May) wind data for Logan International Airport. When considering all spring winds, the prevalent wind directions are from the west-northwest, northwest, west, southwest and east. However, when only the pedestrian-level winds (i.e. 5 feet above ground level) that exceed 16 miles per hour (mph) (Strong Spring Winds) are included in the analysis, the most prominent directions are from the west-northwest, northwest, west, east-northeast and northeast. It should be noted that the 16 mph threshold speed will occur, on average, 1 percent of the time during the spring season in the Boston area.

The second two wind roses in Figure 4-3 illustrate the prevailing summer (June, July, and August) winds blowing from the south through northwest when considering all winds. When only the winds above 12 mph are considered, winds from the west-northwest, southwest, northwest, northeast and west-southwest are predominant.

During the fall months (September, October, and November), winds are predominantly from the southwest through northwest, when considering all winds (see top left wind rose in Figure 4-4). However, when considering winds above the one percent probability threshold of 15 mph (Strong Fall Winds), the northwest, west-northwest, northeast and east-northeast winds prevail (see top right wind rose in Figure 4-4).

For the winter (December, January, and February) wind conditions, the lower left wind rose in Figure 4-4 indicates that the prevailing directions are from the west through northwest, when considering all winds. However, for winds above 17 mph (Strong Winter Winds), the predominant winds are from the west-northwest, northwest and east-northeast, (see lower right wind rose in Figure 4-4). Figure 4-5 summarizes the annual wind data. The top wind rose illustrates that the southwest through northwest winds prevail when considering all winds. For winds above the 16 mph threshold wind speed (Strong Annual Winds), the prevailing wind directions are from the west-northwest, northwest, east-northeast, west and northeast, as shown in the bottom wind rose in Figure 4-5.

The above analyses indicate that higher wind speeds are generally associated with the northeast and northwest quadrant winds, except that in summer a southwest component is added.

4.5 PEDESTRIAN WIND COMFORT CRITERIA

The BRA has adapted two standards for assessing the relative wind comfort of pedestrians. First, the BRA wind design guidance criterion states that an effective gust velocity (mean hourly wind speed +1.5 times the root-mean-square wind speed) of 31 mph should not be exceeded more than 1 per cent of the time. The second set of criteria used by the BRA to determine the acceptability of specific locations is derived from the Melbourne criteria. These criteria are used to determine the relative level of pedestrian wind comfort for activities such as sitting, standing, or walking.

The criteria measured according to mean wind speeds are essentially as follows:

TABLE 4-1
BRA Mean Wind Criteria*

Dangerous Conditions	>27
Uncomfortable for Walking	>19 and ≤27
Comfortable for Walking	>15 and ≤19
Comfortable for Standing	>12 and ≤15
Comfortable for Sitting	<12
* Mean wind speed (mph) exceeded 1 percent of the time. Based on Melbourne wind criteria.	

The wind climate found in a typical urban setting in Boston is generally comfortable for sidewalks and pedestrian thoroughfares. However, without any mitigation measures, this wind climate is likely to be uncomfortable for more passive activities such as sitting.

4.6 PEDESTRIAN-LEVEL WIND ASSESSMENT

The following is a summary of the predicted pedestrian-level wind conditions in and around the development site for the two conditions studied: No-Build and Build.

The wind flows predicted to occur around the two conditions studied have been examined for sixteen (16) wind directions, and sketches of the wind flow patterns for the directions having the greatest influence on increased wind activity (northeast, east-northeast, southwest and northwest) have been included as Figure 4-6 through Figure 4-9. The length of the arrows, which designate wind flow activity, can be roughly translated into anticipated wind strength. For example, a large arrow is representative of fast flowing winds occurring in a particular area. The shaded zones on each sketch highlight areas where increased or accelerated wind conditions are anticipated. Short arrows, showing random flow directions, are representative of slower wind velocities found in sheltered regions such as the downwind side of a building. Arrows irregularly shaped also represent slower wind velocities.

The following assessment approximates the wind comfort levels in the key pedestrian areas around the development site.

Commonwealth Avenue Mall and Crosswalk - No-Build

Mean Wind Speed

Under No-Build conditions, the summer wind climate is presently comfortable for walking-related activities. Higher wind velocities occurring during the spring, fall, winter and annually will create conditions uncomfortable for walking.

Effective Gust

The effective gust criterion will not be exceeded during the spring, summer, fall and annually and will be exceeded during the winter.

Commonwealth Avenue Mall and Crosswalk - Build

Mean Wind Speed

Construction of the study building will not affect the existing seasonal and annual wind environment.

Effective Gust

Construction of the study building will not affect the existing seasonal and annual wind environment.

St. Mary's Street - No-Build

Mean Wind Speed

The summer wind activity along this street is comfortable for standing and walking-related activities. Wind velocities increase along the street, during the spring, fall, winter and annually. The resulting wind climate will vary from suitable for standing to uncomfortable for walking. Generally, the lowest wind speeds will occur on the west side of the street where there is less exposure to northwesterly winds. Uncomfortable wind conditions occur at the east corner of the Commonwealth Avenue intersection (spring, winter, annually), the north corner of the Babbitt Street intersection (spring, fall, winter, annually), the south corner of the Babbitt Street intersection (spring, winter) and towards the middle of the St. Mary's Street Bridge (spring, fall, winter, annually). These areas are more exposed to northwesterly winds deflected into the area by the nearby buildings.

Effective Gust

The effective gust criterion will not be exceeded during the spring, summer, fall and annually at the majority of locations. Wind gusts exceeding the criterion occur on the north side of the Babbitt Street intersection during the spring, winter and annually; and on the south side of the intersection and on the bridge during the winter.

St. Mary's Street - Build

Mean Wind Speed

The study building's interception and deflection of northeast and northwest quadrant winds to grade level will alter existing wind flow patterns. Approximately one third of the street between Commonwealth Avenue and the Massachusetts Turnpike will remain comfortable for walking while the remainder will be considered uncomfortable for walking on a seasonal and annual basis. A localized region of accelerated wind activity on the St. Mary's Street bridge will experience conditions bordering the dangerous category during the spring, fall, winter and annually.

Effective Gust

Acceptable gust wind conditions will remain during the summer. The study building's deflection of northeasterly and northwesterly winds along the street will produce the following changes: unacceptable wind conditions on the east side of the Commonwealth Avenue intersection (winter), the south side of the Babbitt Street intersection (spring and annually), the north side of the Babbitt Street intersection (fall) and portions of the St. Mary's Bridge and vicinity (spring, fall, winter and annually).

Babbitt Street - No-Build

Mean Wind Speed

The seasonal and annual wind conditions along Babbitt Street are generally suitable for walking or better. Uncomfortable wind conditions occur at the northwest corner of the 112 Cummington Street building during the spring and winter and along the north facade of the 22 Babbitt Street building, during the winter. These areas are exposed to northeast and/or northwest quadrant winds deflected into the area by nearby buildings.

Effective Gust

The seasonal and annual gust wind speeds are acceptable with the exception of the south side of Babbitt Street, across from the 728 Commonwealth Avenue building, during the winter.

Babbitt Street - Build

Mean Wind Speed

Babbitt Street will be more exposed to northeast and northwest quadrant winds descending off the study building. Uncomfortable wind conditions will be more common along the street during the spring, fall, winter and annually. Wind speeds, suitable for walking or standing rather than standing or sitting, are anticipated in the area behind the 708 - 714 Commonwealth Avenue buildings, for the four seasons and annually. The summer wind climate along the street will become more suitable for walking than standing.

Effective Gust

The gust wind criterion will not be exceeded during the summer months. It will be exceeded at the west end of the street during the spring, fall, winter and annually; and at the east end of the street in the spring and winter.

Cummington Street - No-Build

Mean Wind Speed

The seasonal and annual wind environment is suitable for walking or better. Uncomfortable wind speeds occur on the east side of the Commonwealth Avenue intersection (spring, fall, winter annually); at the west corner of the 111 Cummington Street building (spring); and at the base of the Warren Towers west facade (winter).

Effective Gust

Acceptable gust wind conditions occur at most locations during the four seasons and annually. Unacceptable gust wind speeds occur at the east corner of the Commonwealth Avenue intersection, during the spring and winter.

Cummington Street - Build

Mean Wind Speed

The study building's redirection of northeast and northwest quadrant winds will decrease the wind activity to the south of the Babbitt Street intersection, during the spring, fall, winter and annually. Uncomfortable wind conditions will continue at the east corner of the Commonwealth Avenue intersection during the spring, fall, winter and annually; and at the southwest corner of the 111 Cummington Street building during the spring. Overall, the seasonal and annual wind environment will generally remain appropriate for walking or better. Only the southwest corner of the 111 Cummington Street building will experience increased wind activity, as a result of the study building's presence. Uncomfortable wind conditions are likely during the fall, winter and annually.

Effective Gust

Acceptable gust wind conditions will prevail seasonally and annually with the exception of the east corner of the Commonwealth Avenue intersection and near the west corner of the 111 Cummington Street building. Unacceptable gust wind speeds are expected at both locations during the spring and winter and to continue at the former location during the fall and annually.

4.7 MITIGATION MEASURES

The project site and environs are a known windy area. In a few locations, the No-Build wind conditions were either uncomfortable or unacceptable. In other areas, the wind conditions were borderline uncomfortable or unacceptable. The addition of the Center for Photonics Research building will increase the wind activity in several areas, resulting in more areas reporting uncomfortable or unacceptable wind conditions.

Despite the presence of mature deciduous trees in the general vicinity, additional wind control measures will be required at the Project site to reduce the year round wind activity in various areas of concern. This is most desirable along Babbitt Street, St. Mary's Street and on the St. Mary's Street Bridge. The Project provides internal connections from the existing building at 110-112 Cummington Street through the Research Center to St. Mary's Street. This alternative route can serve as mitigation to conditions along Babbitt Street.

Various types of additional wind mitigation measures (i.e. building modifications, landscaping, awnings, etc.) are available for use at the site. The types of mitigation measures and their effectiveness will be determined and quantified through further detailed wind tunnel studies.

4.8 CONCLUSION

The proposed building will intercept and deflect upper-level winds down to grade. In the areas of anticipated high wind activity, conditions are primarily due to the exposure of these areas to predominant northeast, southwest and northwest quadrant winds, and the channeling and acceleration of these winds between and around the existing and proposed buildings as summarized below.

A brief summary of the findings is presented as follows, including Table 4-2.

- The Build mean and effective gust wind conditions will remain similar to the No-Build wind conditions on the Commonwealth Avenue Mall and Crosswalk.

- The Build wind speed conditions will generally increase the wind activity on St. Mary's Street. Portions of the street between Commonwealth Avenue and the Massachusetts Turnpike will acquire uncomfortable wind conditions, during the spring, fall, winter and annually. Unacceptable gust winds will also occur more frequently during these same periods, primarily between Babbitt Street and the Massachusetts Turnpike.

- The Build scenario will increase the wind speeds on portions of the St. Mary's Street Bridge. Dangerous wind conditions are predicted during the spring, fall, winter and annually. The gust wind criterion will be exceeded during the spring, fall, winter and annually.

- The Build scenario will generally increase the mean wind speeds along Babbitt Street. Uncomfortable wind conditions will be more common during the spring, fall, winter and annually. The gust wind criterion will be exceeded at the west end of the street during the spring, fall, winter and annually; and at the east end of the street during the spring and winter.

- Wind flows will change along Cummington Street with reductions in wind activity occurring to the south of the Babbitt Street intersection; but, the seasonal and annual wind environment will generally remain appropriate for walking or better. Uncomfortable wind conditions will occur at the southwest corner of the 111 Cummington Street building during the fall, winter and annually. The study building will cause the gust wind criterion to be exceeded at the east corner of the Commonwealth Avenue intersection during the fall and annually and at the southwest corner of the 111 Cummington Street building during the spring and winter.

- The internal circulation of the Project offers an alternative to pedestrians traveling along Babbitt Street. Additional mitigation features will be required to reduce undesired wind activity in areas of concern. The location and type of mitigation will be examined and determined through studies conducted using scale model testing in a wind tunnel.

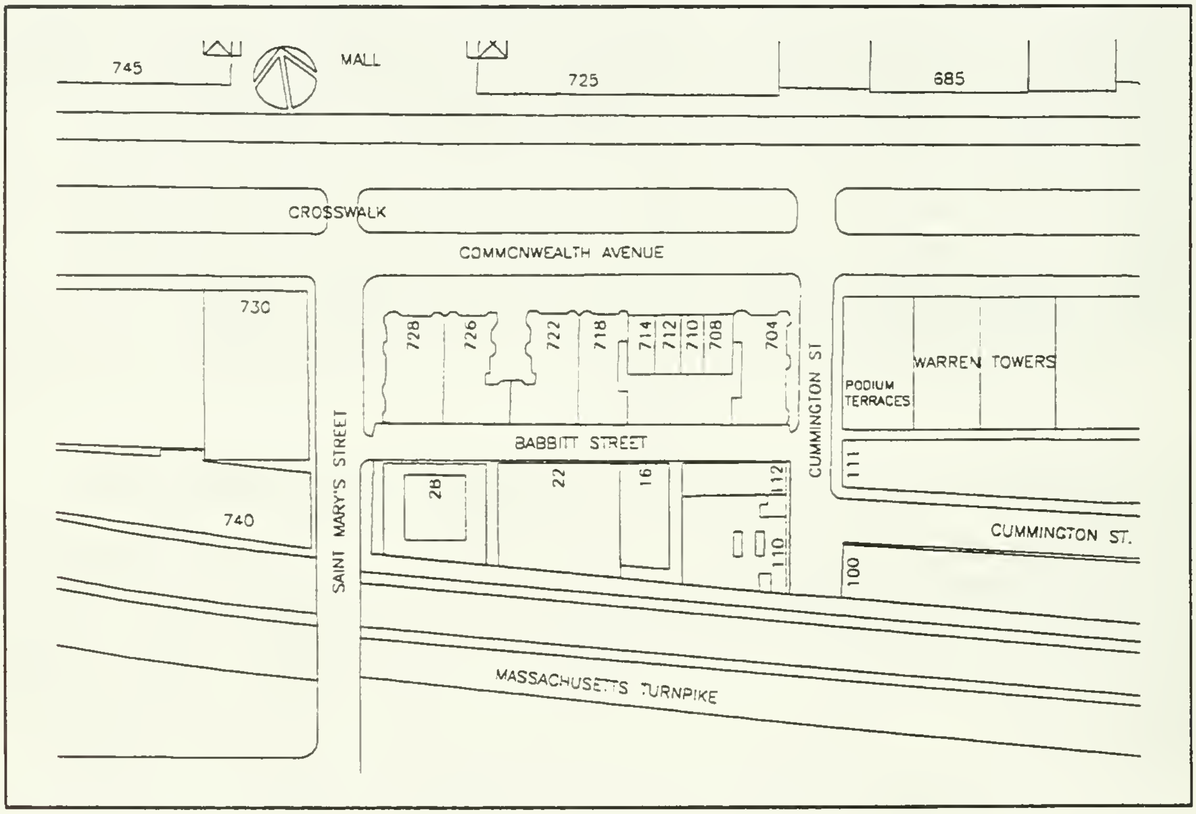
TABLE 4-2
Summary of Pedestrian Level Wind Conditions Qualitative Analysis

Area of Concern	No-Build	Build
Commonwealth Avenue Mall and Crosswalk	M	M
St. Mary's Street	M	M-S
Babbitt Street	M	M-S
Cummington Street	M	M

Legend:

L	Light Low wind conditions that would be suitable for leisurely pedestrian activities
M	Moderate wind conditions that would be acceptable to moving pedestrians but would likely be an annoyance to people sitting or standing stationary for any length of time. May include localized zones of accelerated wind activity considered uncomfortable
S	Strong/Accelerated winds that would be considered an annoyance and/or uncomfortable by people walking, if encountered over a significant distance. This wind activity will likely require corrective measures.

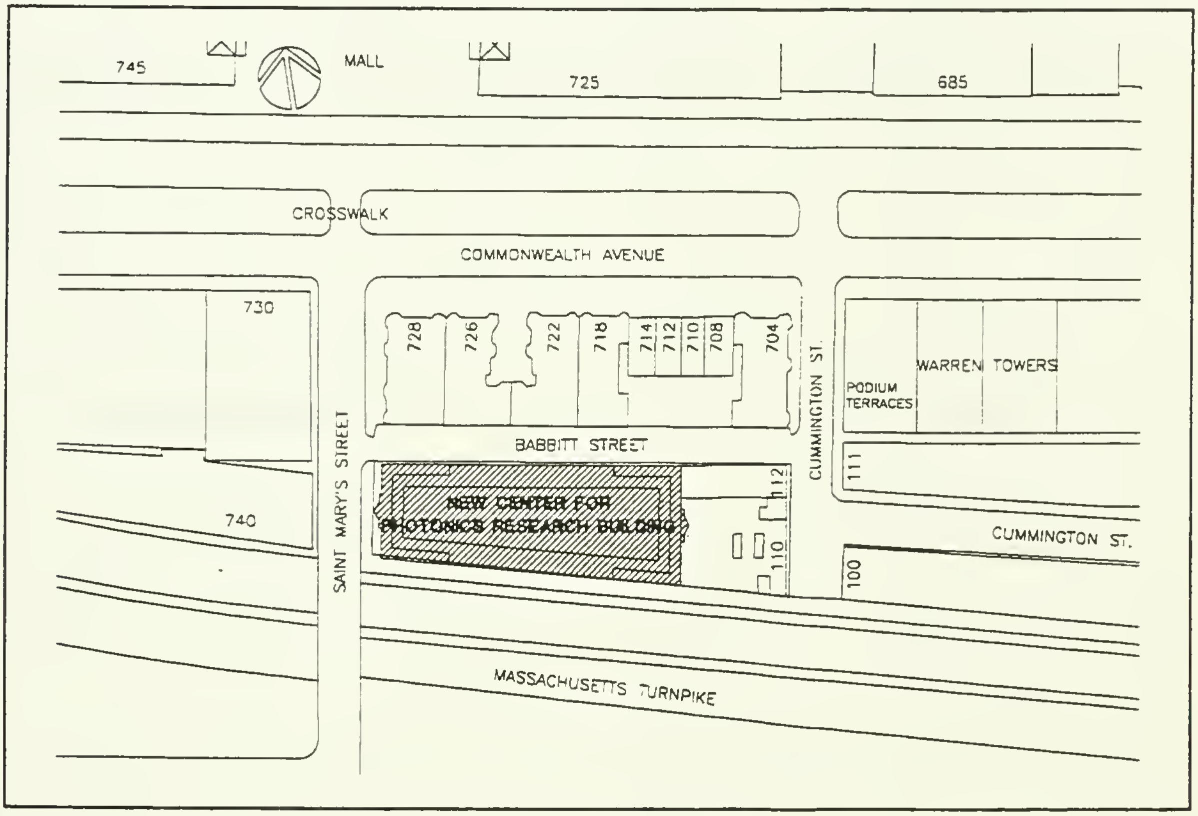
Mitigation options will be developed and tested. Quantitative tests are planned to determine the actual wind conditions at the site and to resolve any outstanding wind control issues. The results will be presented in the Final Project Impact Report on this Project.



Orientation Plan of Wind Study Area - No Build

Prepared By:
Rowan Williams Davies & Irwin, Inc.

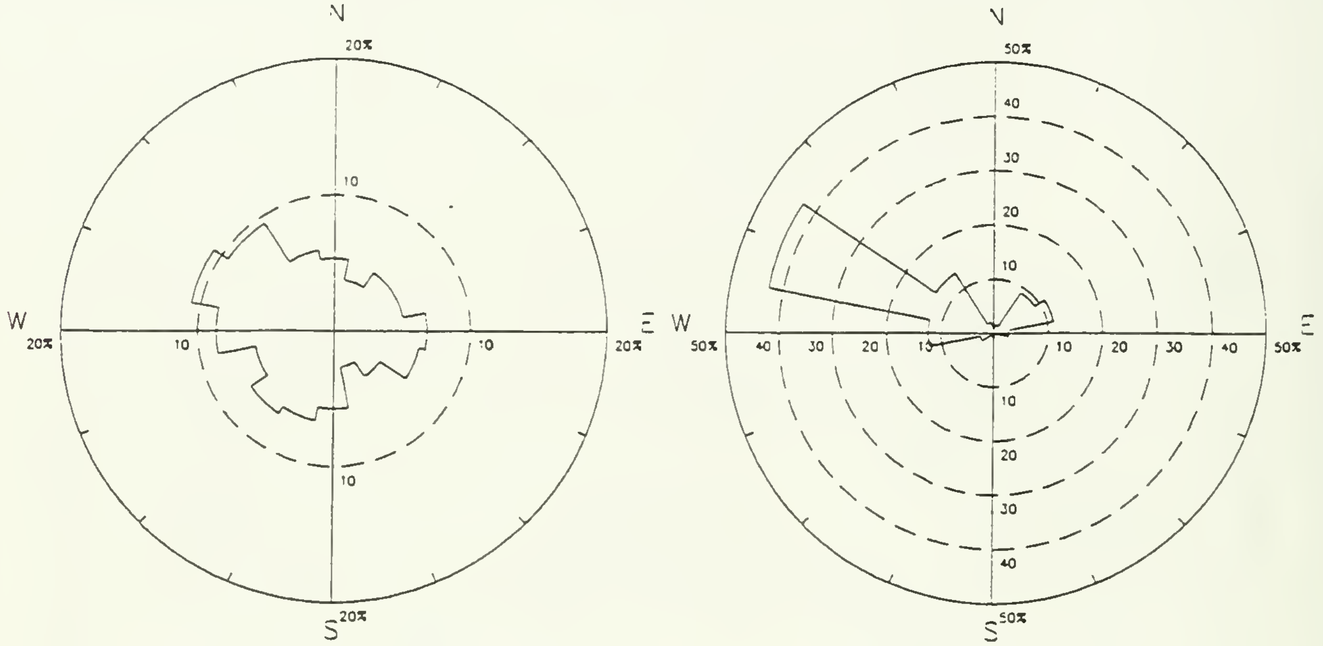
Figure 4-1



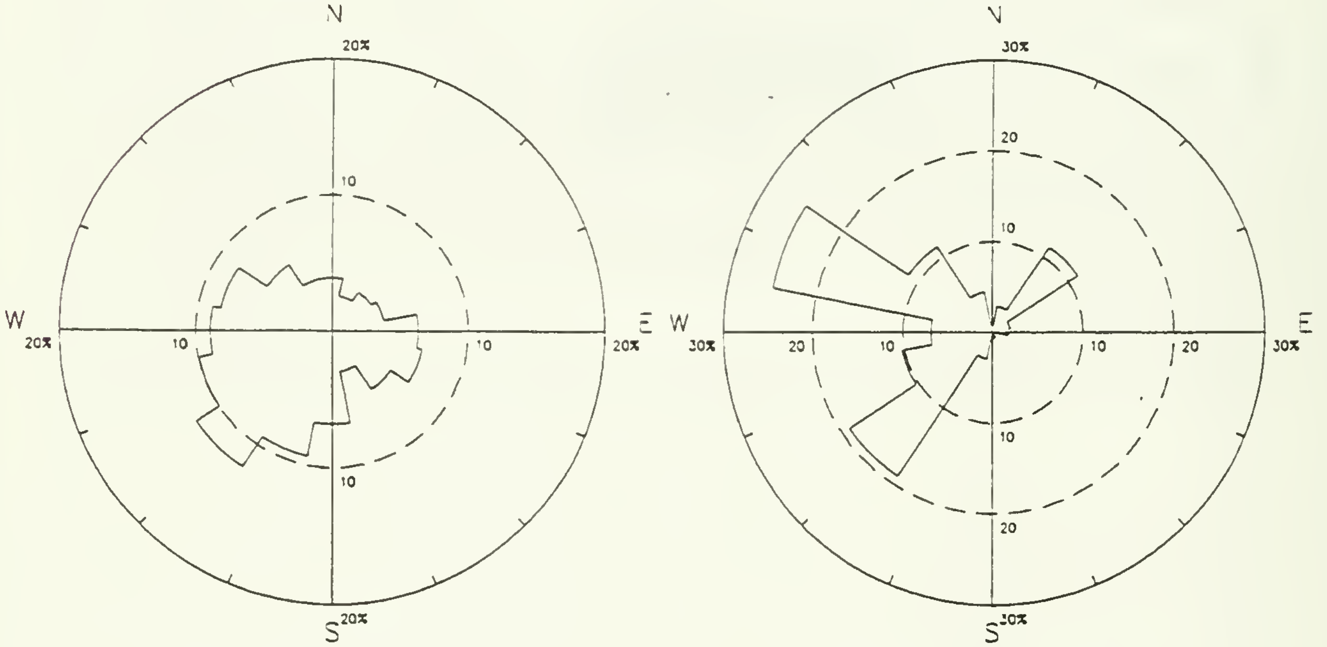
Orientation Plan of Wind Study Area - Build

Prepared By:
Rowan Williams Davies & Irwin, Inc.

Figure 4-2



ALL SPRING WINDS STRONG SPRING WINDS



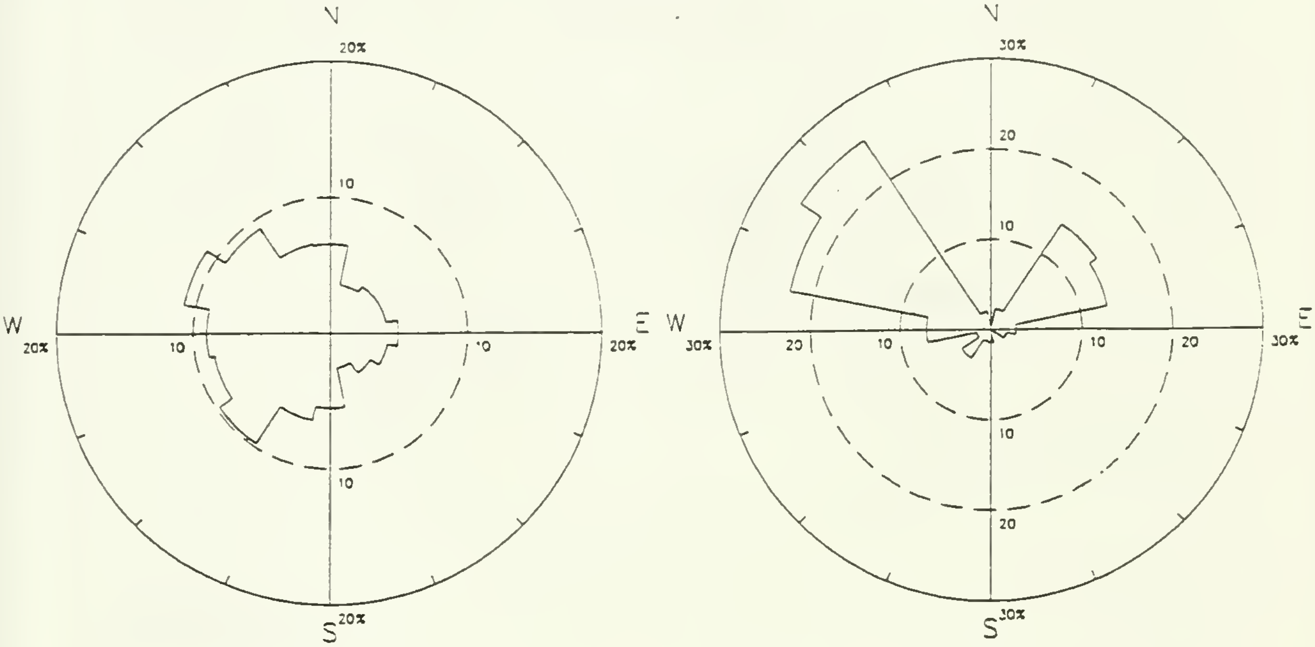
ALL SUMMER WINDS STRONG SUMMER WINDS

Directional Distribution of Spring and Summer Winds

Logan International Airport (1945-1988)

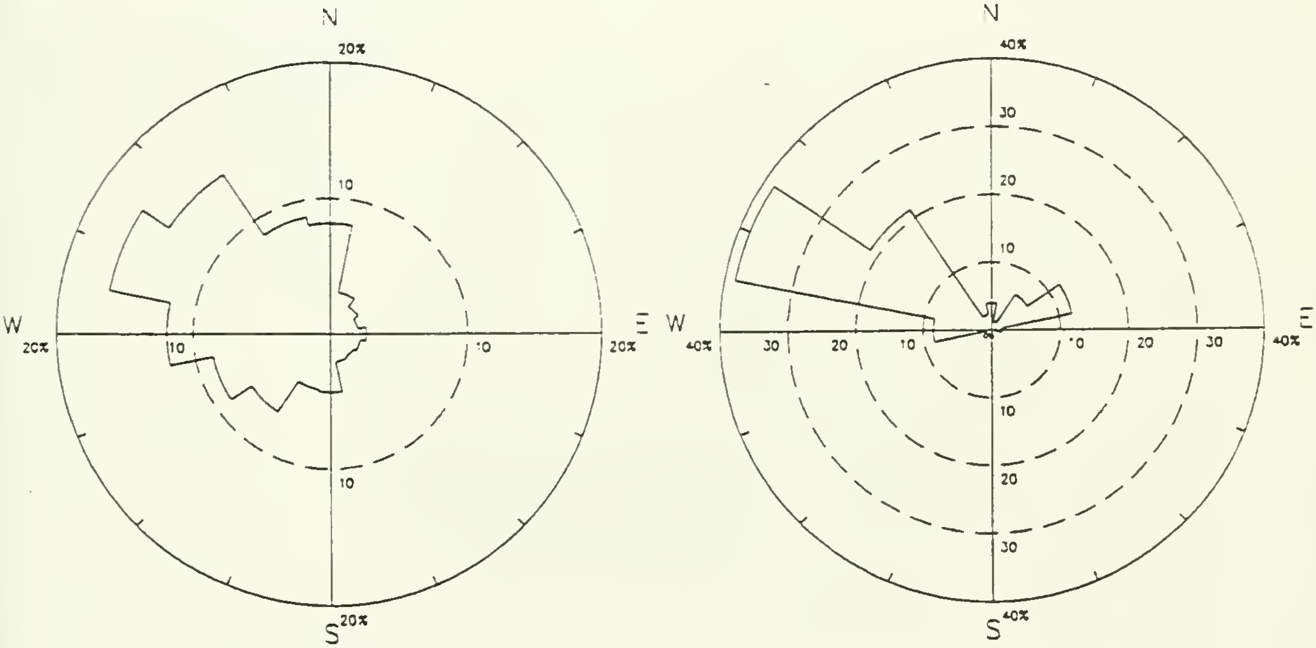
Prepared By:
Rowan Williams Davies & Irwin, Inc.

Figure 4-3



ALL FALL WINDS

STRONG FALL WINDS



ALL WINTER WINDS

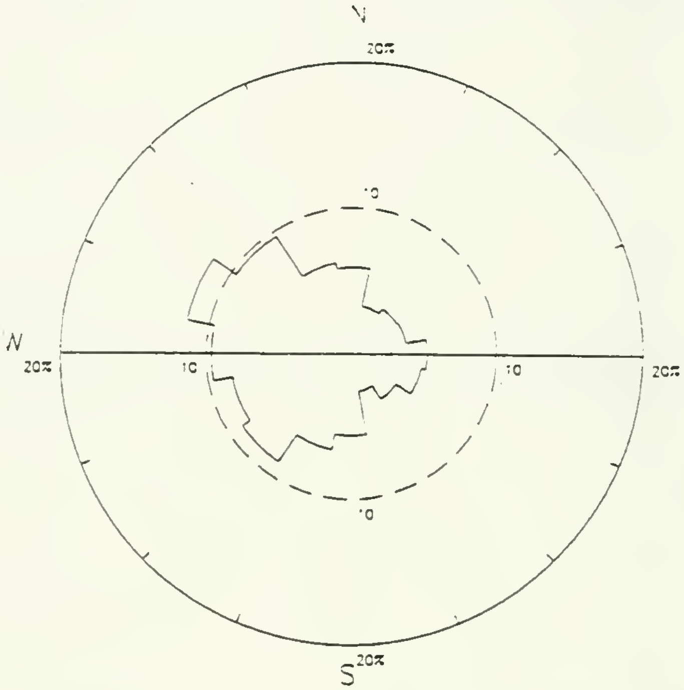
STRONG WINTER WINDS

Directional Distribution of Fall and Winter Winds

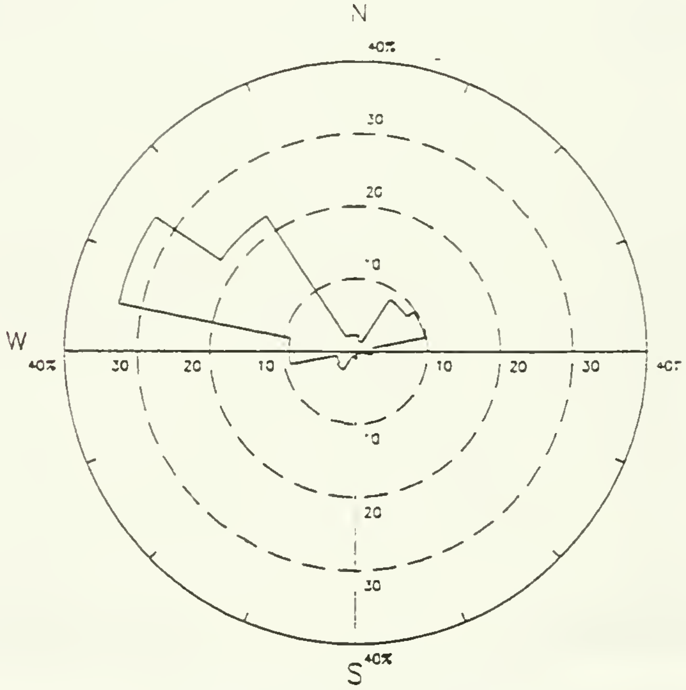
Logan International Airport (1945 - 1988)

Prepared By:
Rowan Williams Davies & Irwin, Inc.

Figure 4-4



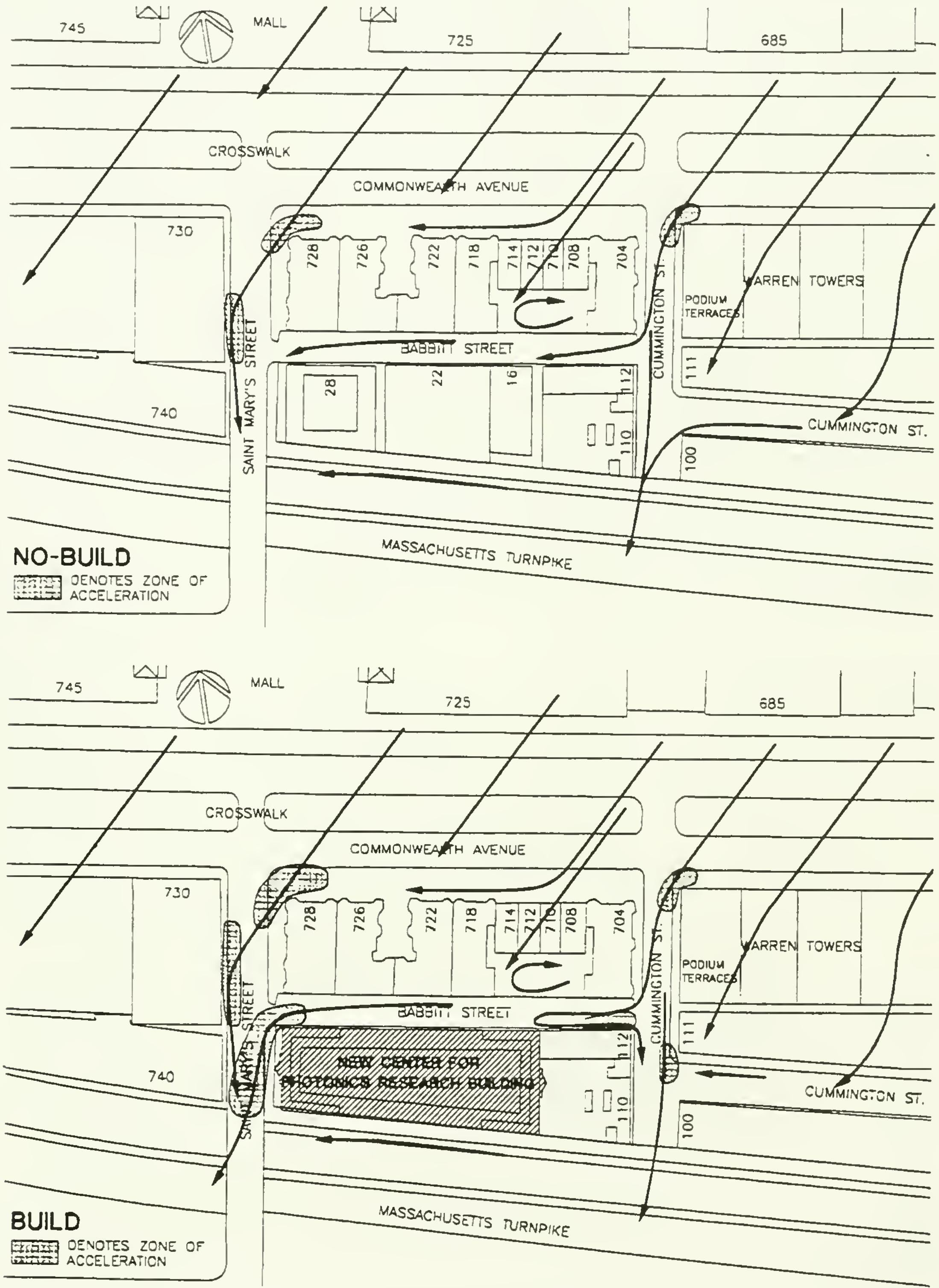
ALL ANNUAL WINDS



STRONG ANNUAL WINDS

Directional Distribution of Annual Winds
Logan International Airport (1945-1988)

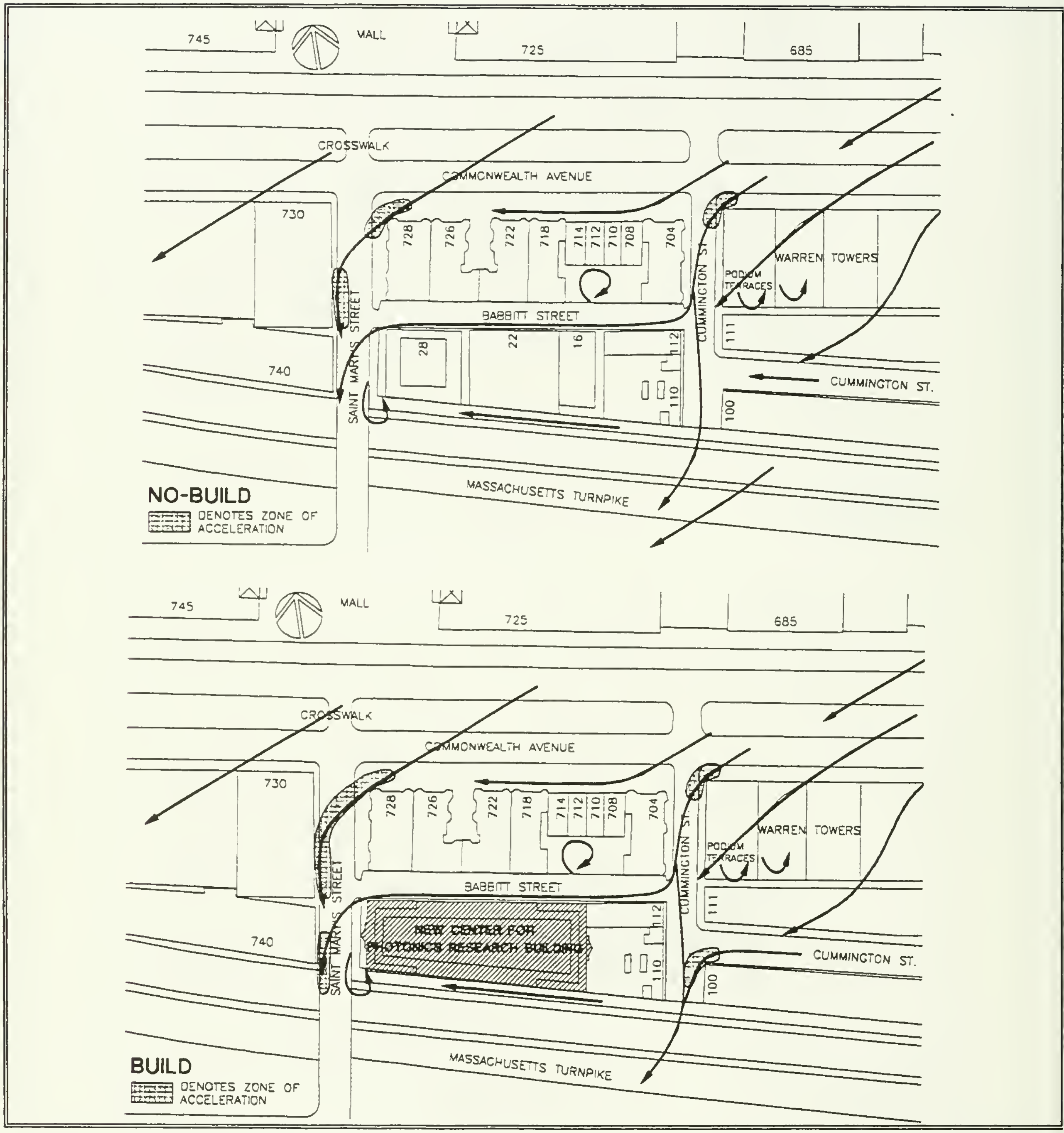
Prepared By: Rowan Williams Davies & Irwin, Inc.	***Figure 4-5***



Wind from the Northeast

Prepared By:
Rowan Williams Davies & Irwin, Inc.

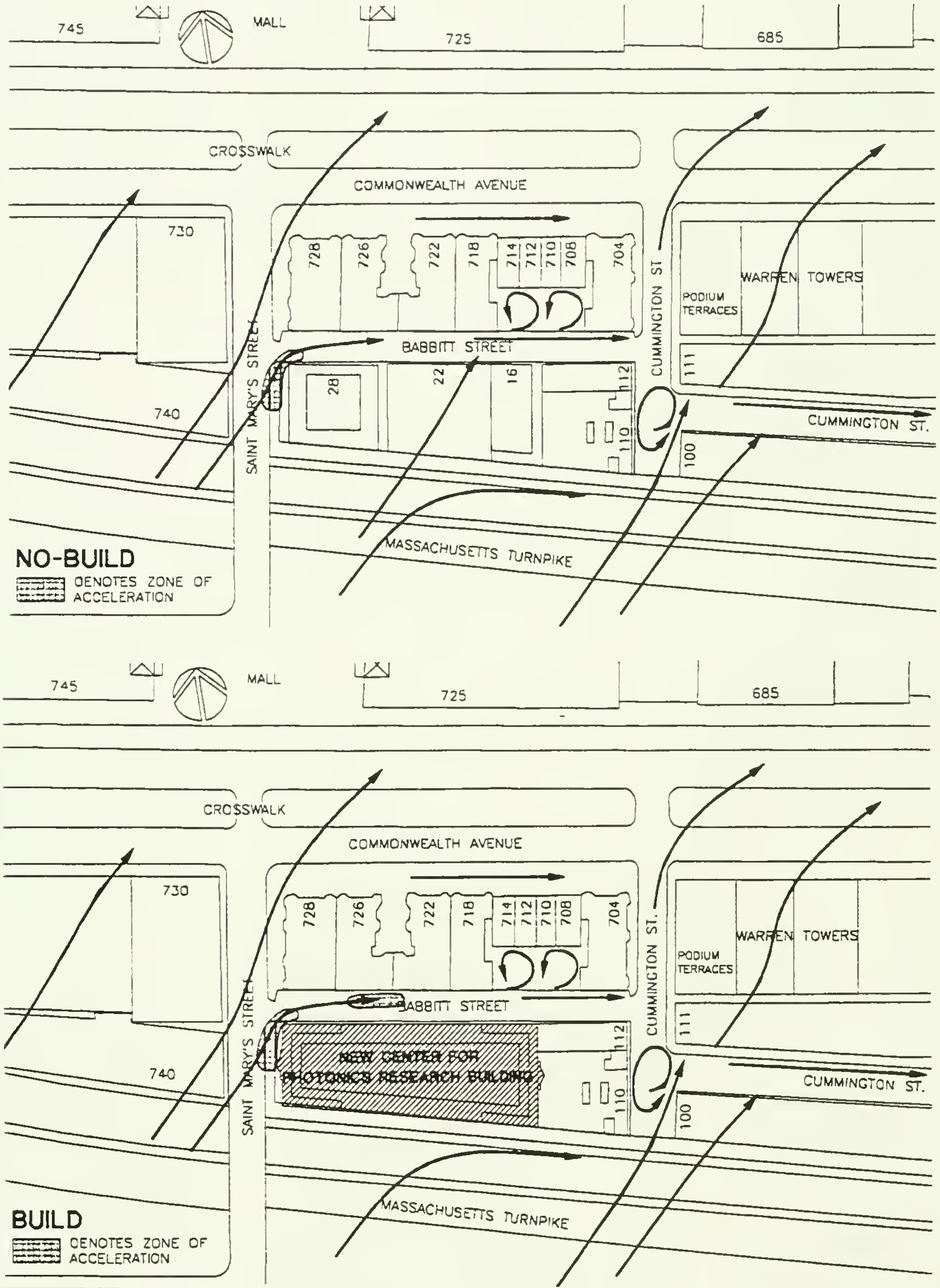
Figure 4-6



Wind from the East-Northeast

Prepared By:
Rowan Williams Davies & Irwin, Inc.

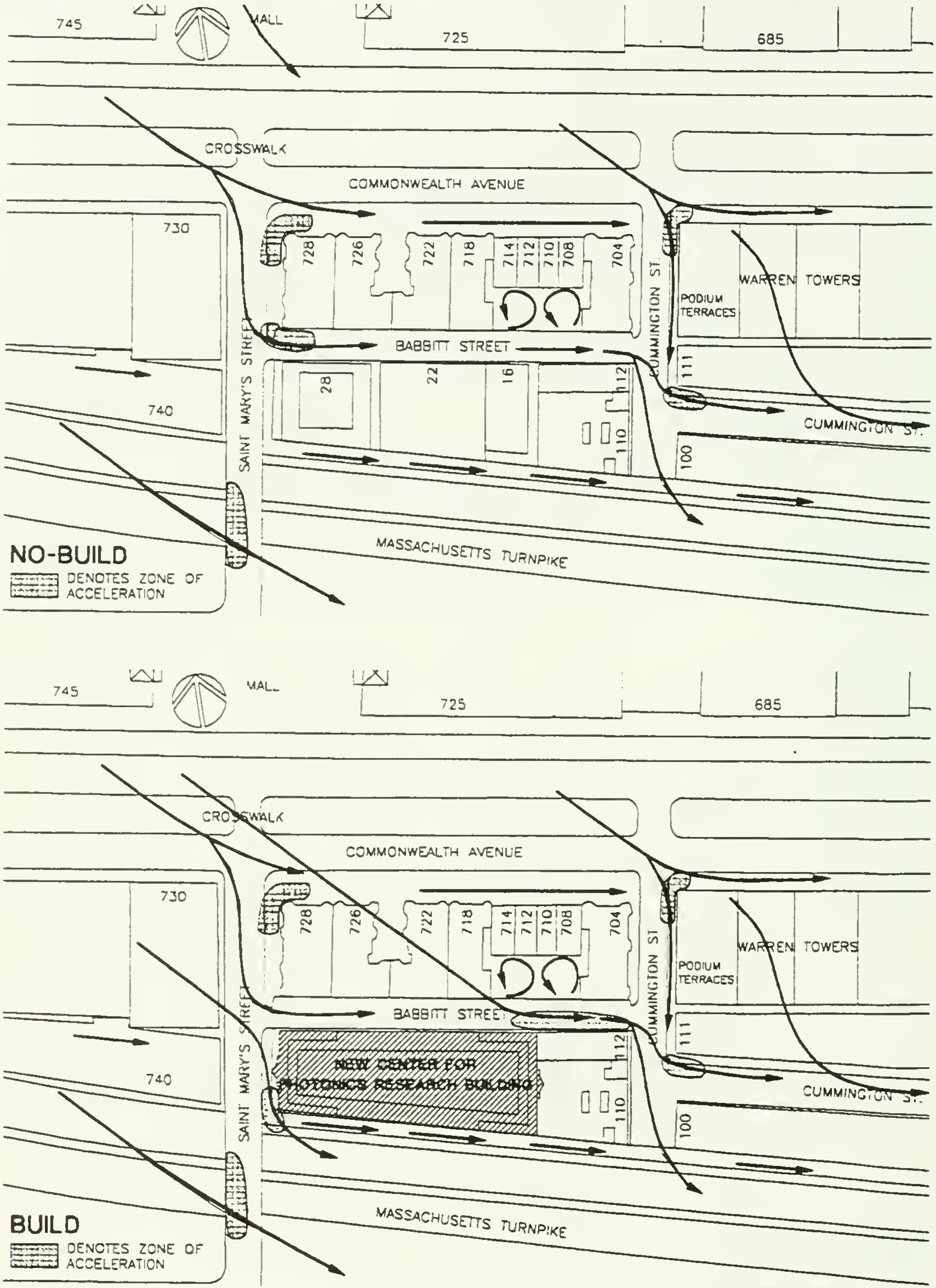
Figure 4-7



Wind from the Southwest

Prepared By:
Rowan Williams Davies & Irwin, Inc.

Figure 4-8



Wind from the Northwest

Prepared By:
Rowan Williams Davies & Irwin, Inc.

Figure 4-9

5.0 SHADOW

5.0 SHADOW

5.1 INTRODUCTION

A shadow analysis was conducted for the proposed Boston University Center for Photonics Research. The objective of the shadow study, achieved by simulating and visually illustrating the shadow conditions which would occur with and without the Project, is to describe the net impact of the shadows cast by the new building as compared with the existing shadow patterns. The areas of greatest interest are nearby sidewalks, public open spaces, and buildings. This report discusses the findings of the shadow analyses for the new Center for Photonics Research building. (Approximately 165 feet above average grade).

5.2 METHODOLOGY

The shadow patterns illustrated in this report were generated with the aid of a computer graphics program which utilized a Computer Aided Design (CAD) scale model of the project and existing surroundings. The CAD model was prepared by Rowan Williams Davies & Irwin Inc. (RWDI) based on information supplied by Cannon Architects.

A CAD generated 3-dimensional model of the study site and surroundings was incorporated into a computer graphics program with the appropriate settings[1,2,3], to simulate the geographic characteristics and solar angles for Boston, Massachusetts.

Table 5-1 identifies the dates and times for which the shadow conditions were simulated. The dates correspond to the vernal equinox, summer solstice, autumnal equinox and the winter solstice. The times listed are either Eastern Standard Time (EST) or Eastern Daylight Saving Time (EDT), whichever is in effect for the respective dates.

Table 5-1
Dates and Times Studied

DATE	**TIME**
March 21 (EST)	9:00 A.M., 12:00 noon, 3:00 P.M..
June 21 (EDT)	9:00 A.M., 12:00 noon, 3:00 P.M.
September 21 (EDT)	9:00 A.M., 12:00 noon, 3:00 P.M.
December 21 (EST)	9:00 A.M., 12:00 noon, 3:00 P.M.
Source: RWDI	

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[1] Bennet, Robert, Sun Angles for Design, Bala Cynwyd, PA. 1978.

[2] Duffet-Smith, Peter, Practical Astronomy with your Calculator, Cambridge University Press, Cambridge, Massachusetts, 1979.

[3] The Astronomical Almanac, Data for Astronomy, Space Sciences, Geodesy, Surveying, Navigation and Other Applications for the Year 1987.

The simulations conducted for this study assume bright sunlight from sunrise to sunset, in order to properly identify shadow patterns created by the new structure. Landscaping is not considered on the test configurations and therefore the shadow patterns identified are those created by the various building masses.

The resultant computer generated renderings included as Figures 5-2 through 5-13 exhibit the simulated shadow conditions anticipated to occur on and around the study site. The darker shadows visible in the renderings indicate the shadows cast by the existing buildings. The lighter shadow indicates the additional shadow cast by the proposed Center for Photonics Research building.

5.3 RESULTS

The rendered drawings in Figures 5-2 through 5-13 visually identify the shadows anticipated to occur on and around the study site for the dates and times indicated. Figure 5-1 is an orientation plan provided for convenience in reviewing the results. Reference to both the text and computer renderings (Figures 5-2 through 5-13) provide a detailed description of the existing and proposed shadow patterns.

Vernal Equinox/March 21 (Figures 5-2 through 5-4)

At 9:00 A.M., the additional shadow cast by the new Center for Photonics Research building will cover the section of Babbitt Street, adjacent to the study site; and the section of St. Mary's Street, between Babbitt Street and the Massachusetts Turnpike. It's shadow will also extend to parts of the east and south facades and roof of the Boston University's 730 Commonwealth Avenue building, parts of the east facade and roof of the Boston University's 740 Commonwealth Avenue building and the south facades and roof sections of the 718 - 728 Commonwealth Avenue buildings (owned by the University).

At noon, these additional shadows will recede to the portion of the east sidewalk of St. Mary's Street, and cover the north half of Babbitt Street. The shadows will extend to south facades, and just reach roof sections of the 712 and 714 Commonwealth Avenue buildings and the south facades and roof sections of the 718 - 728 Commonwealth Avenue buildings, immediately north of the study site.

At 3:00 P.M., most of Babbitt Street will be in the study building's shadow as will a wedge of Cummington Street, north of the Babbitt Street intersection. The shadow will also incorporate the south facades and roof sections of the 704 - 728 Commonwealth Avenue buildings, sections of the University's 110-112 Cummington Street building and parts of the west facade of the Warren Towers student residences.

Summer Solstice/June 21 (Figures 5-5 through 5-7)

During this time of year, additional shadow from the Research Center will, at 9:00 A.M., touch only the section of St. Mary's Street, adjacent to the study site; a portion of the north shoulder of the Massachusetts Turnpike and the east facade and roof section of the 740 Commonwealth Avenue building, opposite the study site.

At noon, the shadow impact from the study building will only occur on the east half of St. Mary's Street, between the Massachusetts Turnpike and the north side of Babbitt Street; and along the segment of Babbitt Street, adjacent to the study building.

By 3:00 P.M., Babbitt Street, the south facades of the University's 718 - 726 Commonwealth Avenue buildings, sections of the 110-112 Cummington Street building's roofs will be partially in shade. Shadow from the Center for Photonics Research building will include a small wedge of Cummington Street.

Autumnal Equinox/September 21 (Figures 5-8 through 5-10)

The shadow conditions during the Autumnal Equinox will be similar to those described for the Vernal Equinox. At 9:00 A.M., net new shadow cast by the study building will cover St. Mary's Street between Babbitt Street and the Massachusetts Turnpike, Babbitt Street opposite the study building, parts of the east and south facades and roof of the 730 Commonwealth Avenue building, parts of the east facade and roof of the 740 Commonwealth Avenue building, the southeast corner of the 730 Commonwealth Avenue parking garage roof. Shadows will reach the south facades and touch the roofs of the 722 - 728 Commonwealth Avenue buildings.

By noon, additional shadow will extend approximately half way into St. Mary's Street between Commonwealth Avenue and the Massachusetts Turnpike, the segment of Babbitt Street opposite the study building, the south facades and roof portions of the 718 - 728 Commonwealth Avenue buildings and the corner of the 714 Commonwealth Avenue building.

At 3:00 P.M., the net new shadows will reach the roofs and south facades of the 704 - 728 Commonwealth Avenue buildings immediately to the north of the study site. A narrow band of shadow will also reach the west side of Cummington Street, north of the Babbitt Street intersection, having crossed over approximately half of the 110-112 Cummington Street building's roofs.

Winter Solstice/December 21 (Figures 5-11 through 5-13)

The longest shadows of the year will occur during the winter solstice when the sun is very low on the horizon. At 9:00 A.M., the shadow from the Project will reach the south facade of the 745 Commonwealth Avenue building, located on the north side of Commonwealth Avenue. Included in its path will be the east facade and rooftop of the 730 Commonwealth Avenue building. A portion of Commonwealth Avenue and the south facades and rooftops of the 718 - 728 Commonwealth Avenue building will also experience shadows.

At noon, additional shadow from the study building will extend across Commonwealth Avenue to the south facade of the 725 Commonwealth Avenue building and the plaza area in front of the 735 Commonwealth Avenue building. Included in its path will be the 712 - 728 Commonwealth

Avenue buildings and the east side of St. Mary's Street, north of the Massachusetts Turnpike. Babbitt Street is primarily in shadow cast by the existing buildings.

By 3:00 P.M., which is approaching sunset for this time of year, net new shadow cast by the study building will extend northeast onto the roofs of the 704 - 728 Commonwealth Avenue buildings and the 725 and 685 Commonwealth Avenue buildings, situated on the north side of Commonwealth Avenue. A narrow band of shadow will also fall on the roof of the Warren Towers low rise element. No net new shadows extend to the Bay State Road Historic District or Charles River Basin at the study times except for a small notch on Storrow Drive, filling in the extensive existing shadow at this time of year.

5.4 CONCLUSION

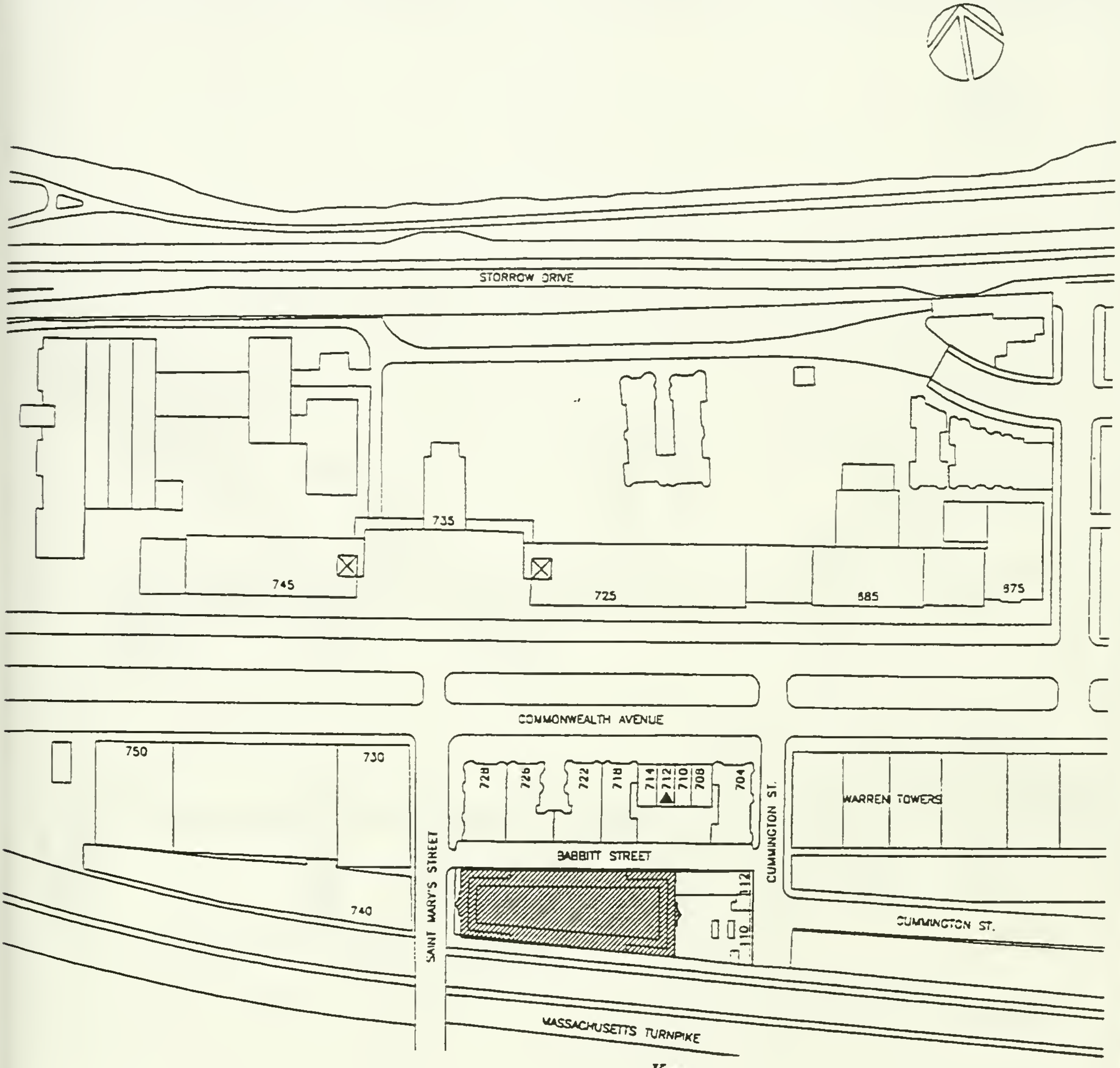
Most of the affected areas are already subject to shadows by existing buildings. The net new shadows created by the new building do not significantly impact any historic districts or sensitive public areas even during the winter solstice.

In general, the additional shadows cast by the Center for Photonics Research building will affect only the immediate surrounding streets and buildings:

- in the morning (9:00 A.M.), these areas typically consist of St. Mary's Street, south of Babbitt Street, a section of Babbitt Street, the south facades and roofs of the 718-728 Commonwealth Avenue buildings and the east facades and roofs of the 730 and 740 Commonwealth Avenue buildings;

- in the afternoon, the shaded areas consist primarily of Babbitt Street, the eastern portion of St. Mary's Street, and the south facades of the 718 - 728 Commonwealth Avenue buildings; and

- by late afternoon (3:00 P.M.) shadows from the study building will fall on most of Babbitt Street, small wedges of Cummington Street, the east facades and roofs of the 704 - 728 Commonwealth Avenue buildings and the roofs of the 110-112 Cummington Street building.



Key:

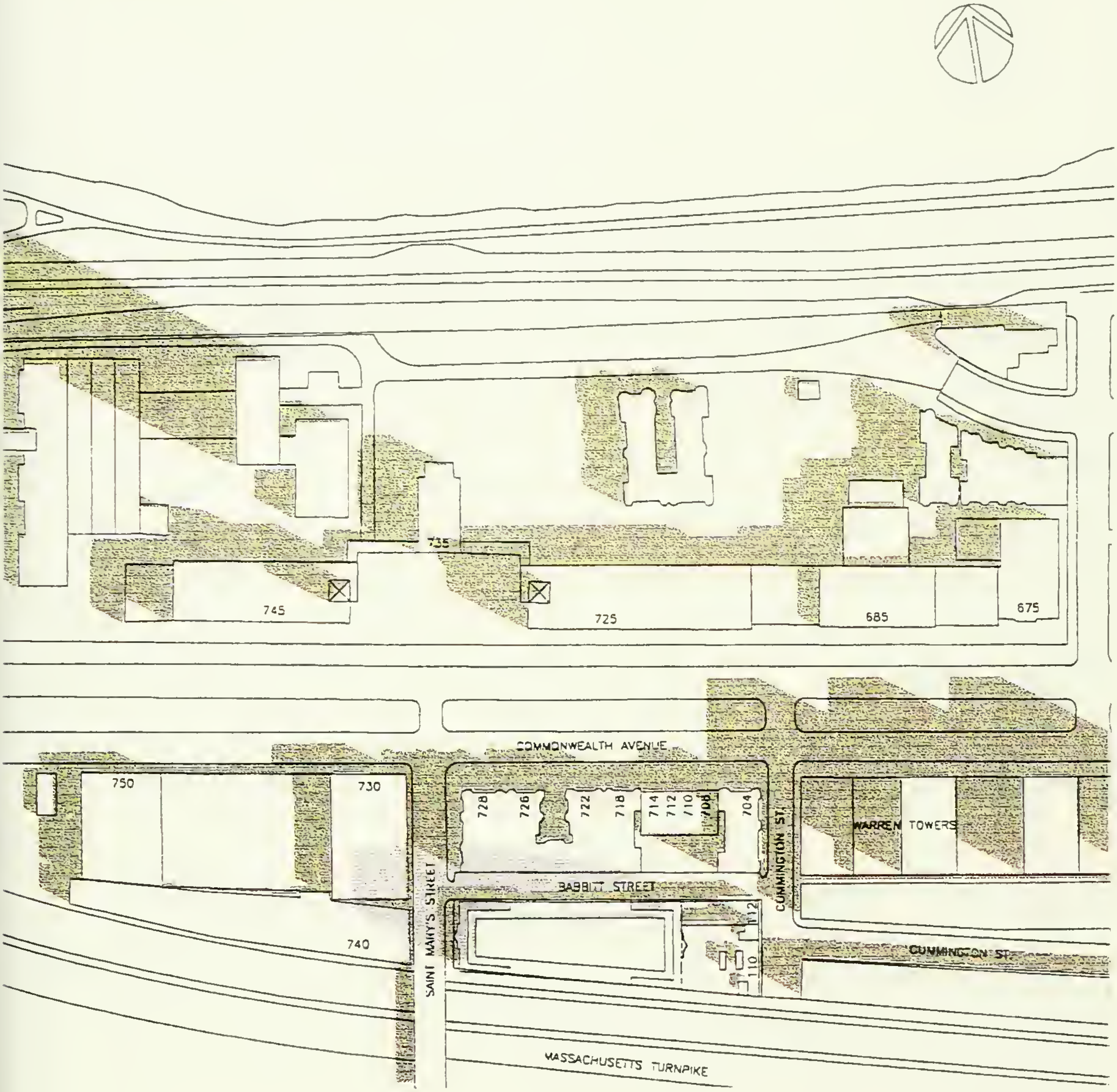
▨ New Center for Photonics Research Building

▲ Non-University Owned Property

Shadow Orientation Plan

Prepared By:
Rowan Williams Davies & Irwin Inc.

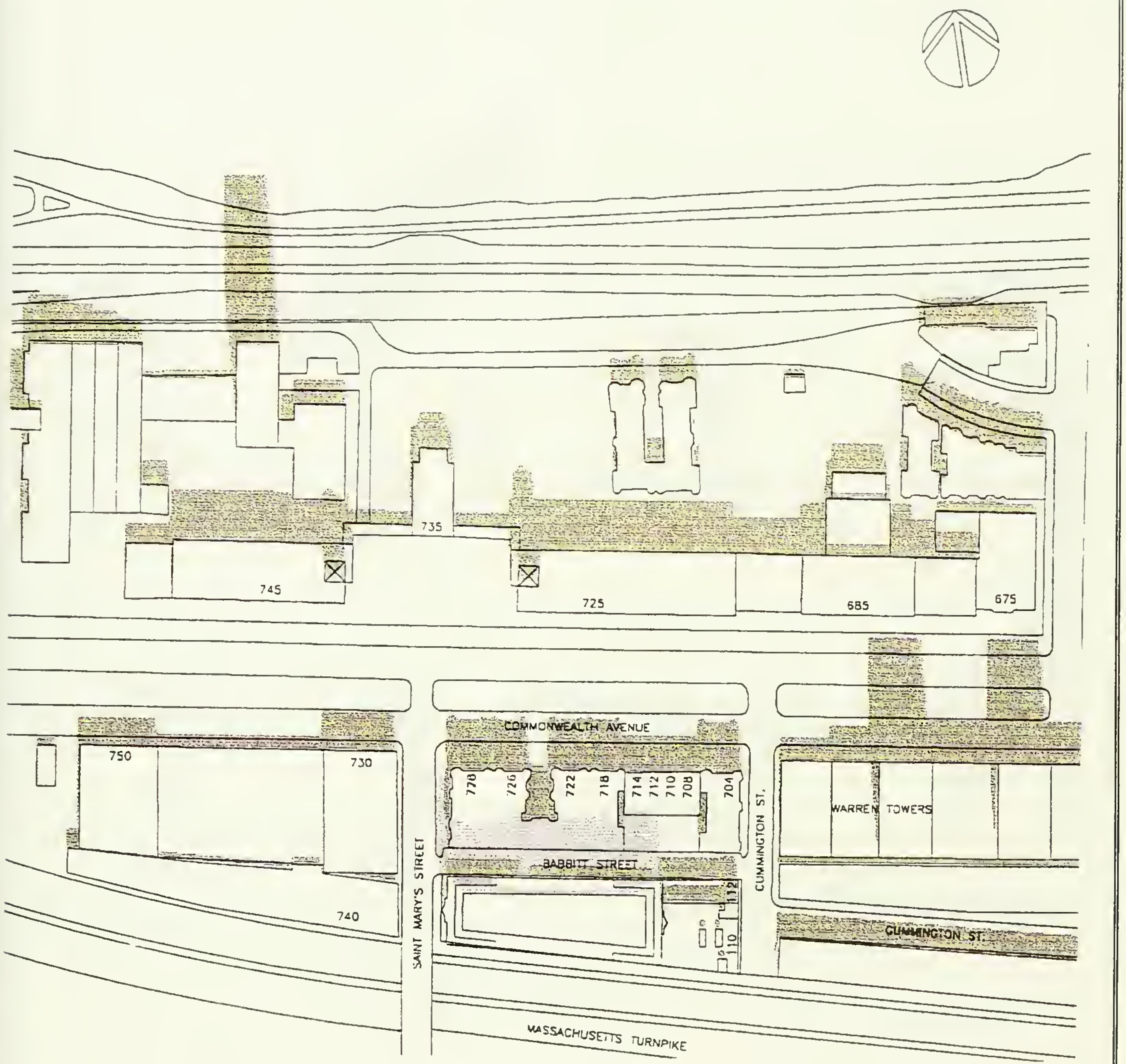
Figure 5-1



Shadow March 21, 9:00 A.M.

Prepared By:
Rowan Williams Davies & Irwin Inc.

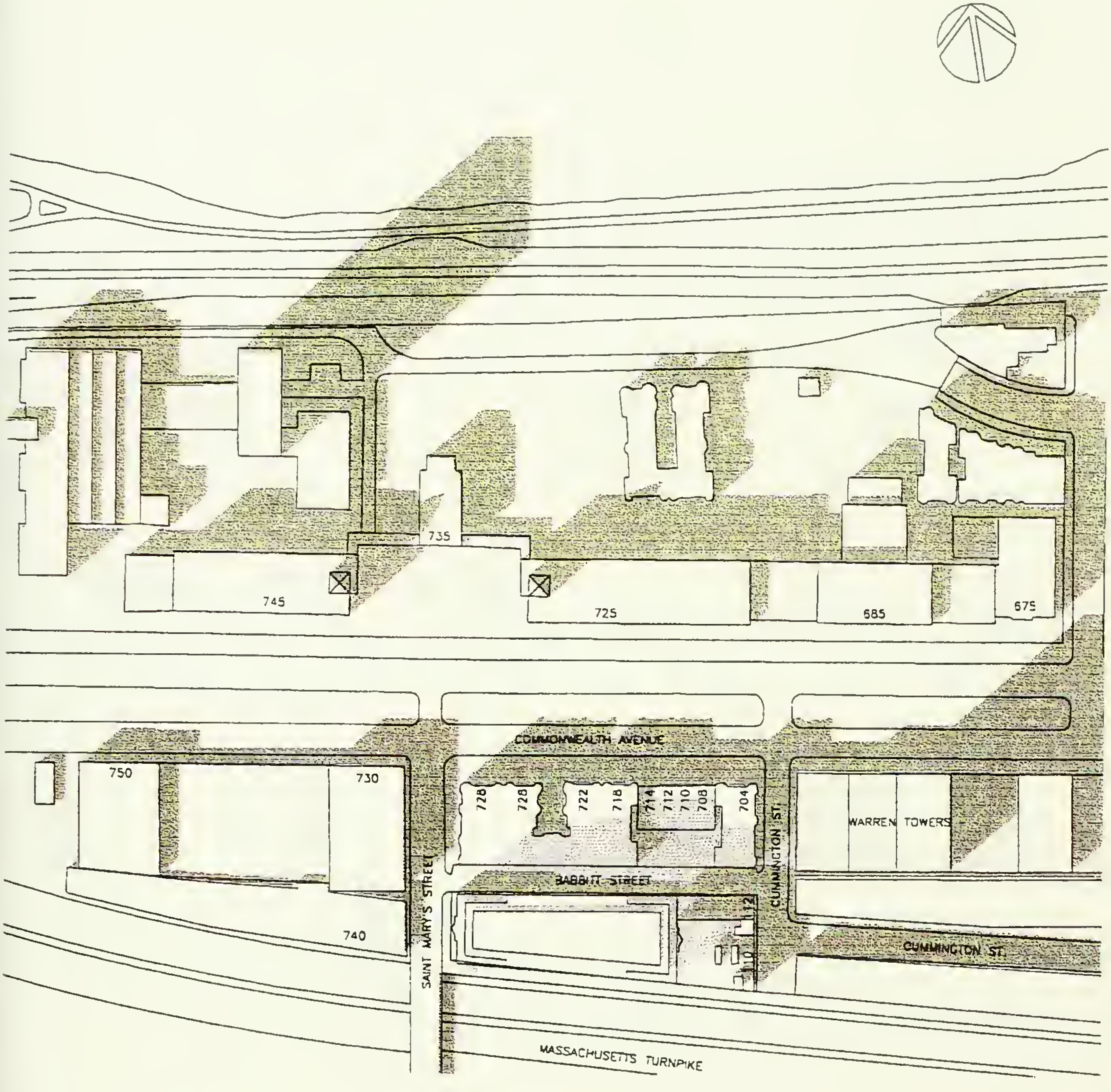
Figure 5-2



Shadow March 21, Noon

Prepared By:
Rowan Williams Davies & Irwin Inc.

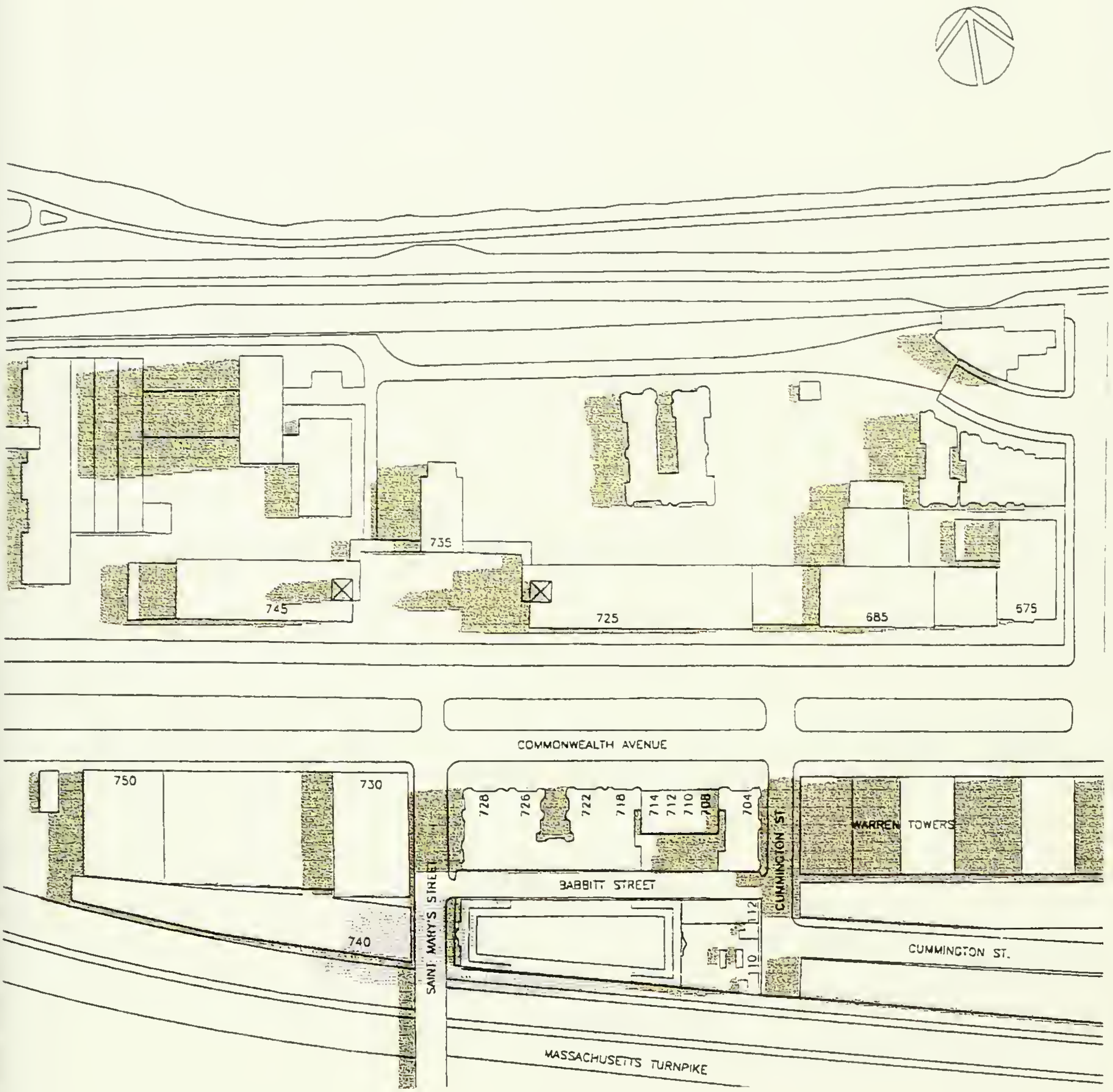
Figure 5-3



Shadow March 21, 3:00 P.M.

Prepared By:
Rowan Williams Davies & Irwin Inc.

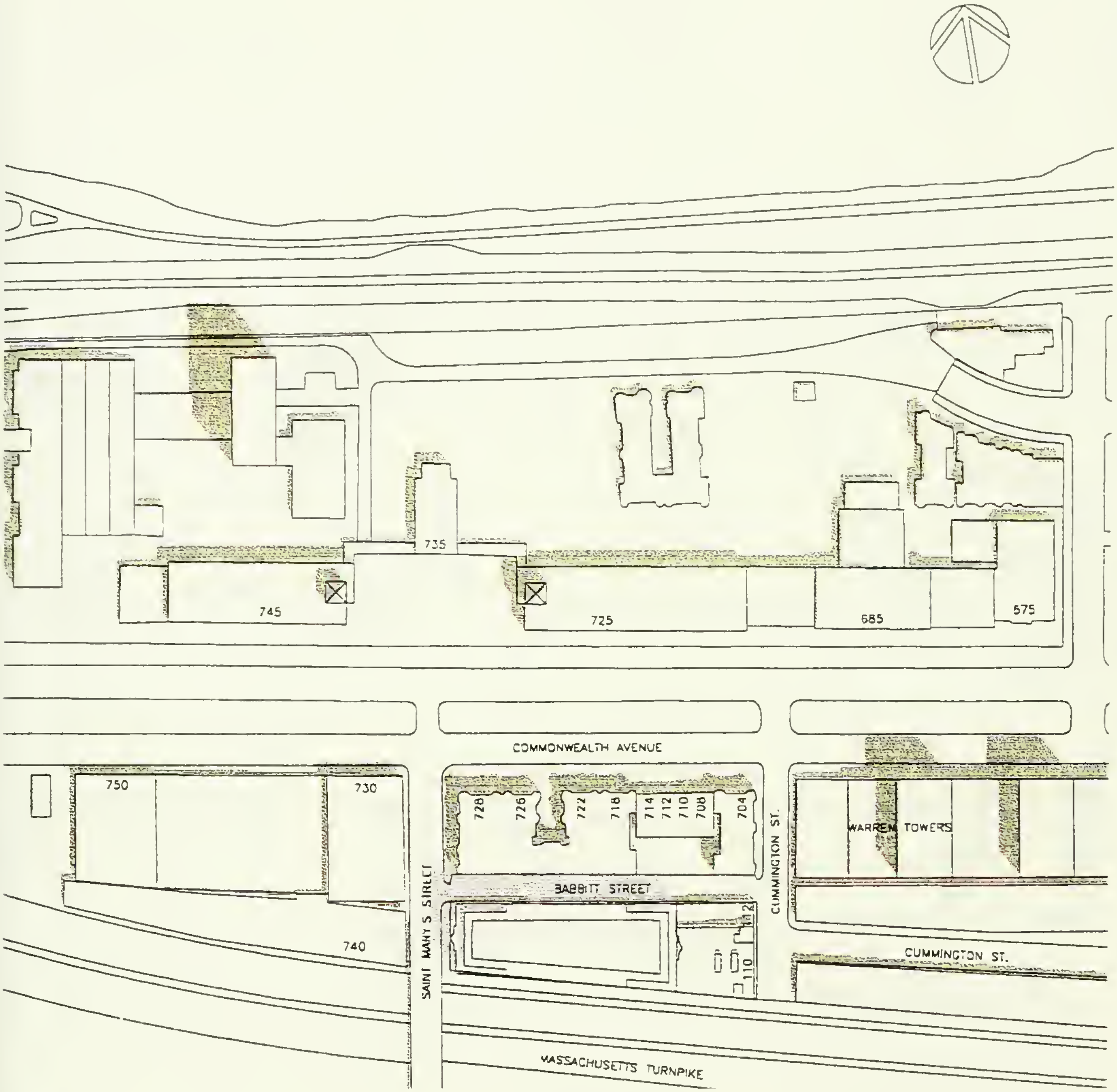
Figure 5-4



Shadow June 21, 9:00 A.M.

Prepared By:
Rowan Williams Davies & Irwin Inc.

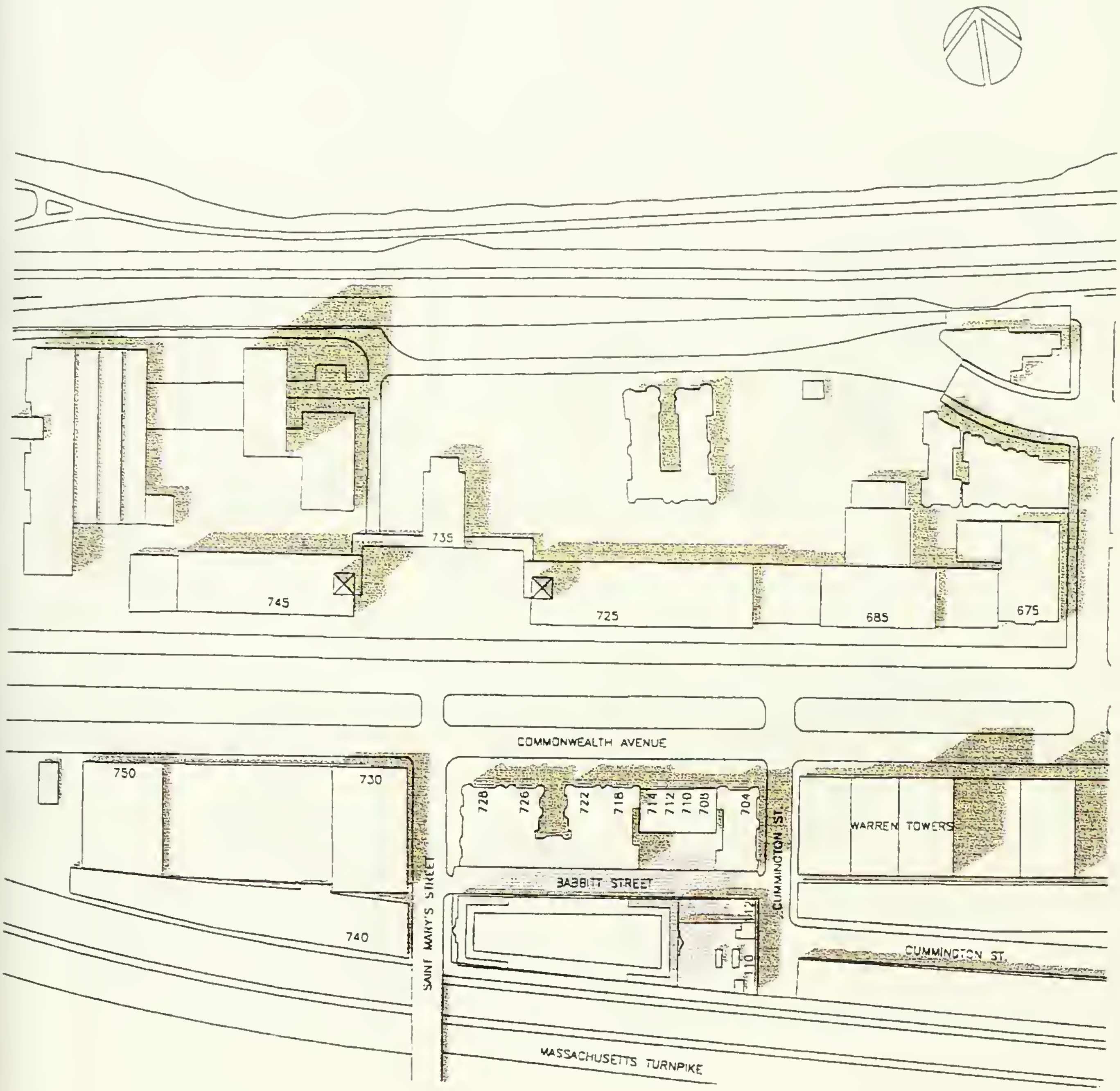
Figure 5-5



Shadow June 21, Noon

Prepared By:
Rowan Williams Davies & Irwin Inc.

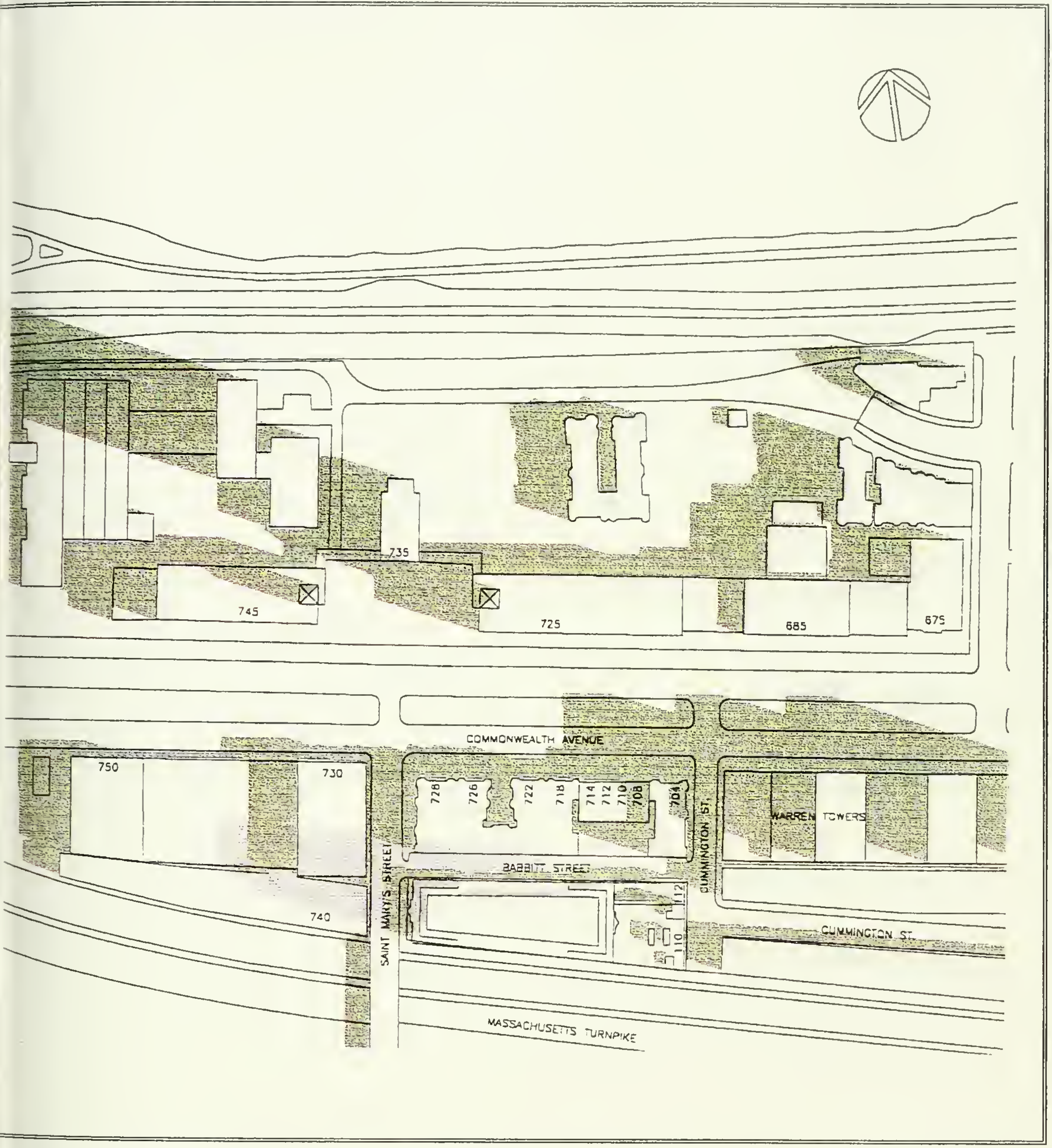
Figure 5-6



Shadow June 21, 3:00 P.M.

Prepared By:
Rowan Williams Davies & Irwin Inc.

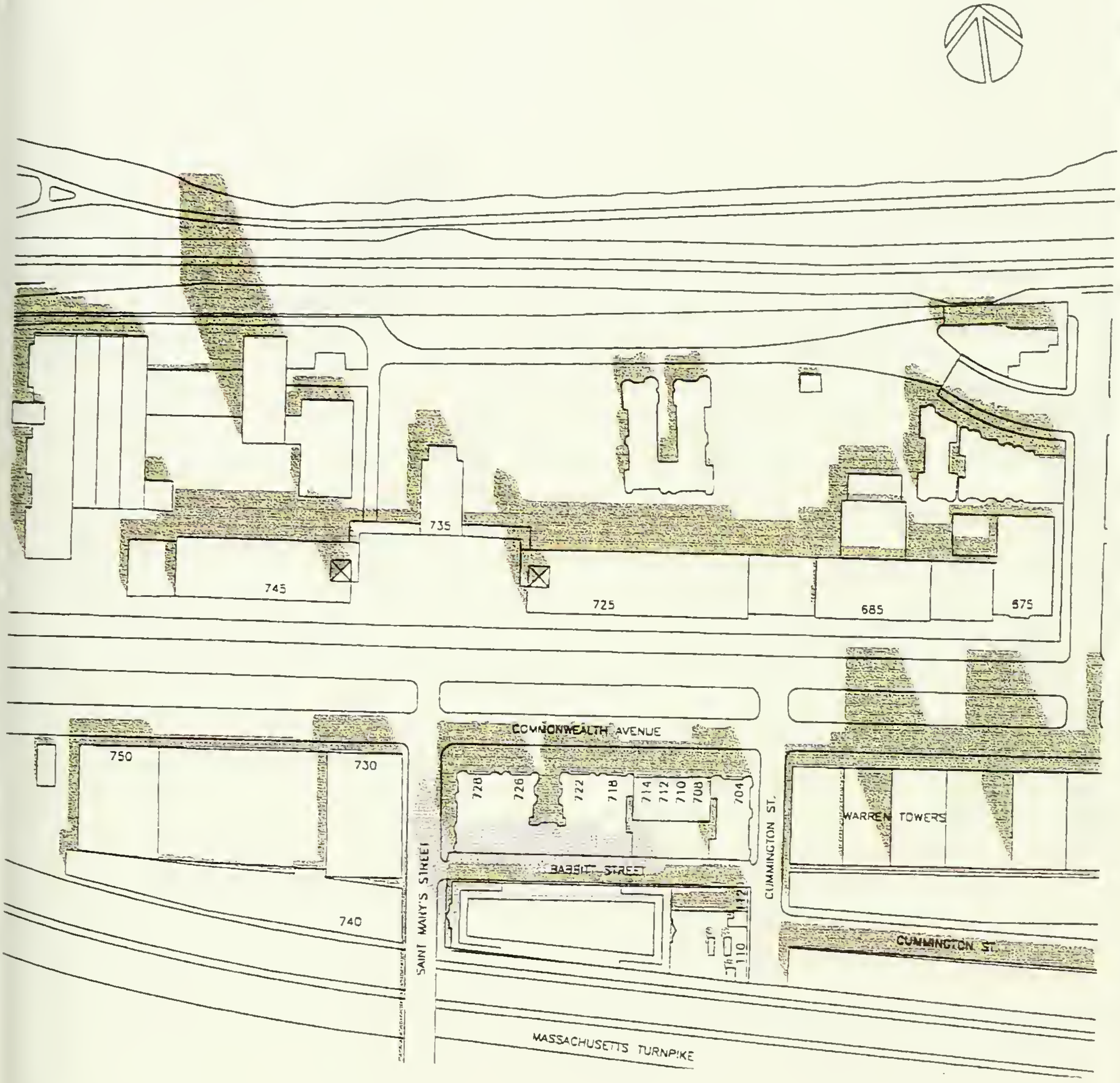
Figure 5-7



Shadow September 21, 9:00 A.M.

Prepared By:
Rowan Williams Davies & Irwin Inc.

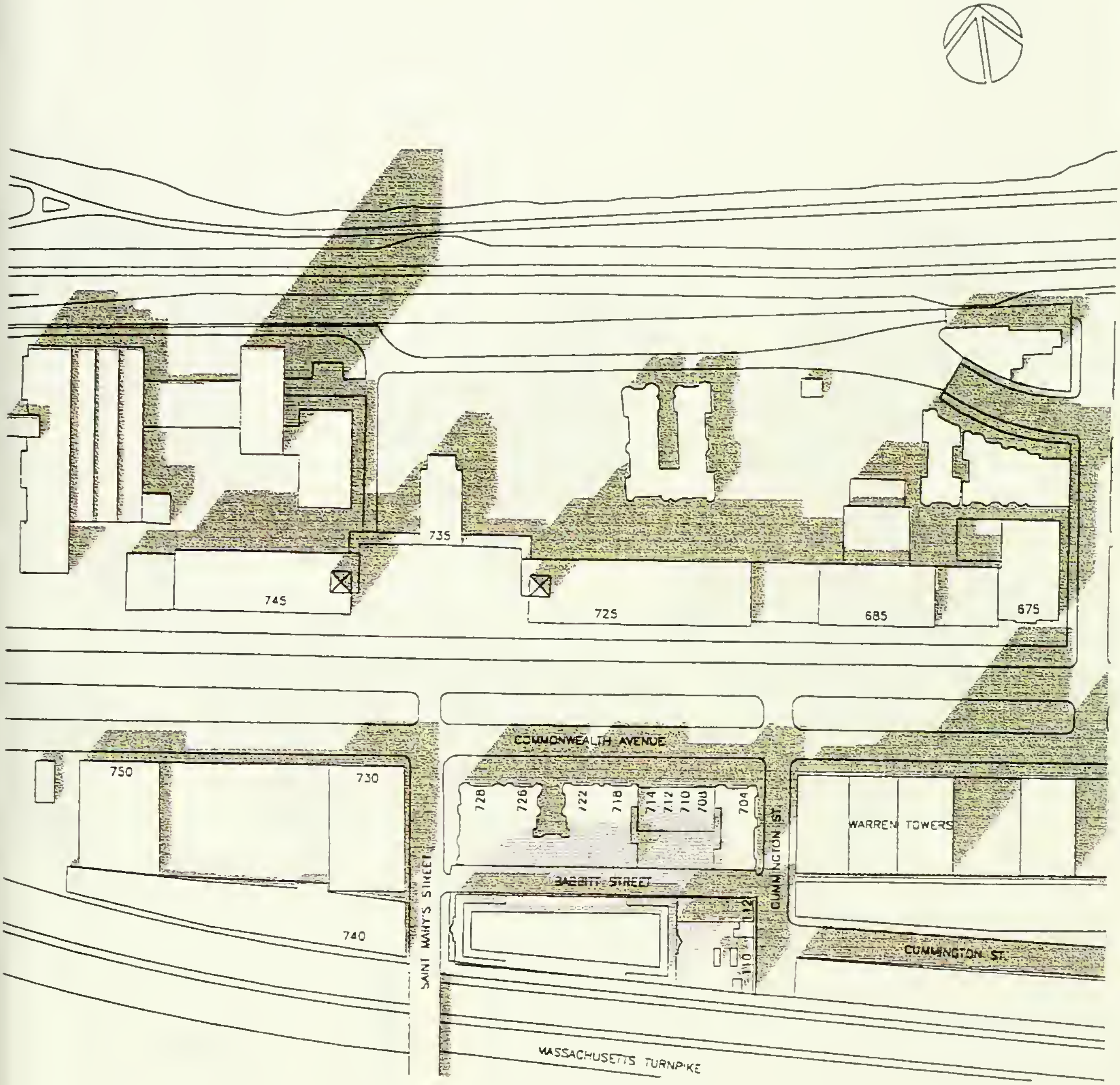
Figure 5-8



Shadow September 21, Noon

Prepared By:
Rowan Williams Davies & Irwin Inc.

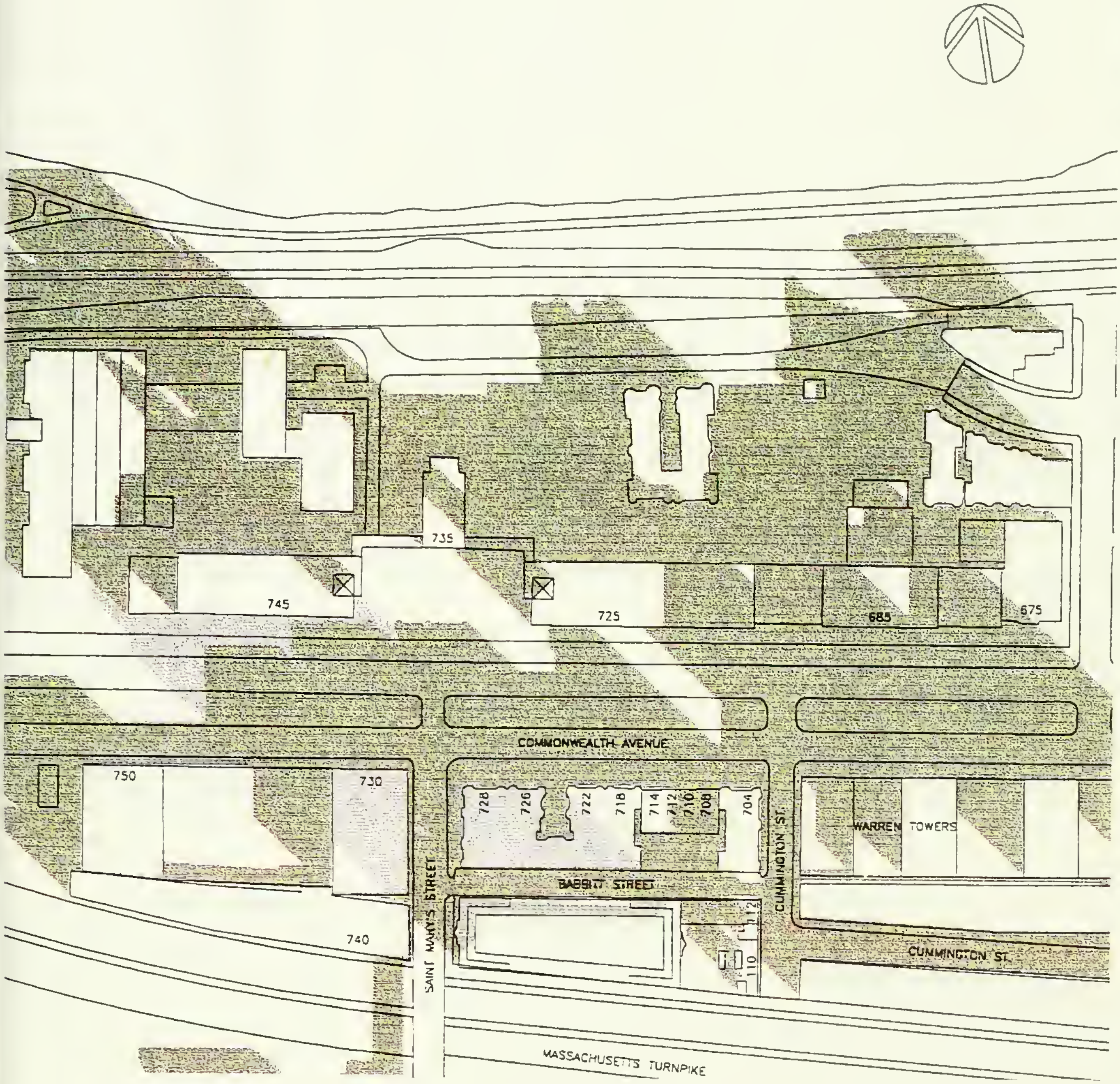
Figure 5-9



Shadow September 21, 3:00 P.M.

Prepared By:
Rowan Williams Davies & Irwin Inc.

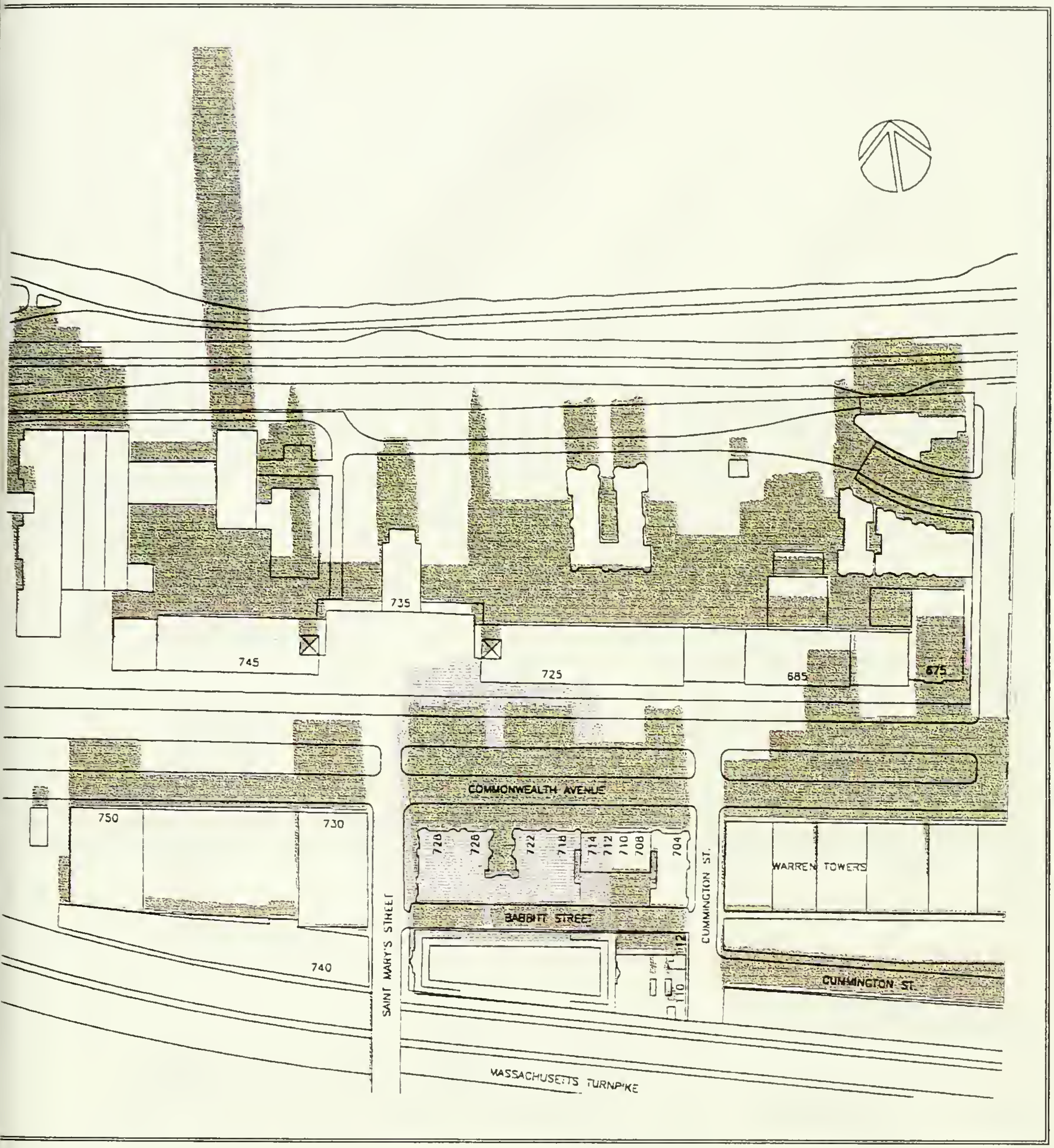
Figure 5-10



Shadow December 21, 9:00 A.M.

Prepared By:
Rowan Williams Davies & Irwin Inc.

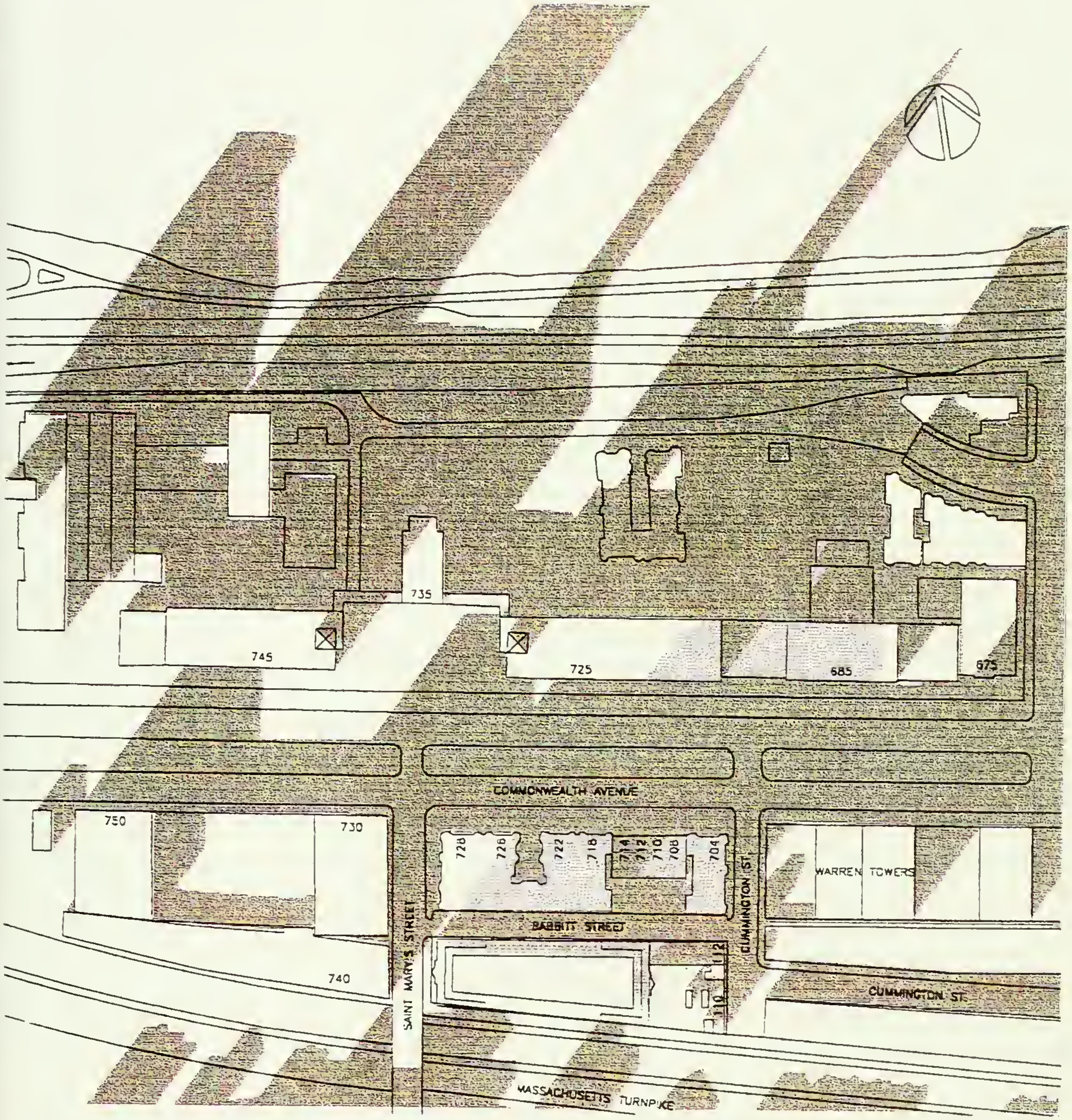
Figure 5-11



Shadow December 21, Noon

repared By:
Rowan Williams Davies & Irwin Inc.

Figure 5-12



Shadow December 21, 3:00 P.M.

Prepared By:
Rowan Williams Davies & Irwin Inc.

Figure 5-13

6.0 DAYLIGHT

6.0 DAYLIGHT

6.1 INTRODUCTION

A daylight analysis using the Boston Redevelopment Authority's Daylight Analysis (BRADA) computer software was conducted for the Boston University Center for Photonics Research project. The BRADA program analyzes a building's silhouette to ascertain how much daylight is perceived by a viewer at ground level locations selected by the Boston Redevelopment Authority (BRA). The results of the program contrast the percentage of daylight obstructed by a building to the percentage obstructed if the same site were vacant where the more daylight is represented by lower values and less daylight represented by higher values.

The BRADA analysis was conducted for three buildings. These include the proposed Research Center building, a hypothetical building representing the existing Manufacturing-2 zoning (M-2) classification, and an existing building located at 44 Cummington Street in the science complex.

6.2 METHODOLOGY

As specified in the BRA Scoping Determination, three viewpoints were used in the analysis: Babbitt Street, Massachusetts Turnpike, and St. Mary's Street. Each view was oriented on the center of the site from the middle of the street as specified in the program. The Massachusetts Turnpike right-of-way includes the New York Central Railroad corridor. For the purposes of this study, the railroad corridor is excluded leaving an approximately 140 foot wide roadway. The BRADA analysis, therefore, reflects this view from approximately 70 feet from the edge of the Project site.

To develop a hypothetical building representing a FAR of 2.0 (as required by the BRA), a two story building, approximately 24 feet high, was created covering the site. This approximates existing conditions on the site. The BRADA model was then applied accordingly for the three specified viewpoints. The M-2 zoning classification was applied to the property before Boston University ownership and is not an appropriate zoning classification for a site containing academic uses. A building reflecting M-2 zoning, therefore, is not a useful comparison for development on the Project site. A further discussion of zoning is provided in Chapter 3.0, Zoning and Master Plan Consistency.

The daylight analysis for the Project includes the 110-112 Cummington Street building, which will remain on the Project site. This building is approximately 3-4 stories high with no setbacks from the property line. It should be noted that buildings in the immediate vicinity of the Project site reflect a higher density than 2.0 FAR allowed in the M-2 zone. Buildings abutting Babbitt Street across from the Project site contain four and five story buildings with little, if any, setbacks.

The science and engineering building, located at 44 Cummington Street, was analyzed for a more useful comparison of daylight values of buildings in close proximity to the Project site. 44 Cummington Street is approximately one block from the Project site and within the University's science and engineering complex. This building is an eight story brick building built in 1987 which contains science and engineering laboratories, classrooms and other academic facilities. It abuts the Massachusetts Turnpike and Cummington Street. A view orientation plan is provided in Figure 6-1.

6.3 RESULTS

The results of the daylight analyses for all views are summarized below in Table 6-1. The table includes daylight obstruction values for the Project and the hypothetical two-story building from Babbitt Street, St. Mary's Street, and the Massachusetts Turnpike views. This table shows daylight values for the 44 Cummington Street building from Cummington Street and the Massachusetts Turnpike views. Figures 6-2 through 6-9 graphically depict the daylight analyses results.

The daylight analyses indicate that the Project will reflect similar daylight values, as viewed from the Turnpike and St. Mary's Street, to those created by 44 Cummington Street as viewed from the Turnpike and Cummington Street. The daylight values from the Turnpike will be 65.2 for the Project compared to 60.6 for 44 the Cummington Street building. The values from St. Mary's Street will result in daylight value of 86.2 for the Project compared to a value of 83.9 for the 44 Cummington Street building viewed from Cummington Street. The view from Babbitt Street, which is essentially a narrow alley, will result in a higher daylight value of 92.0 for the proposed Research Center.

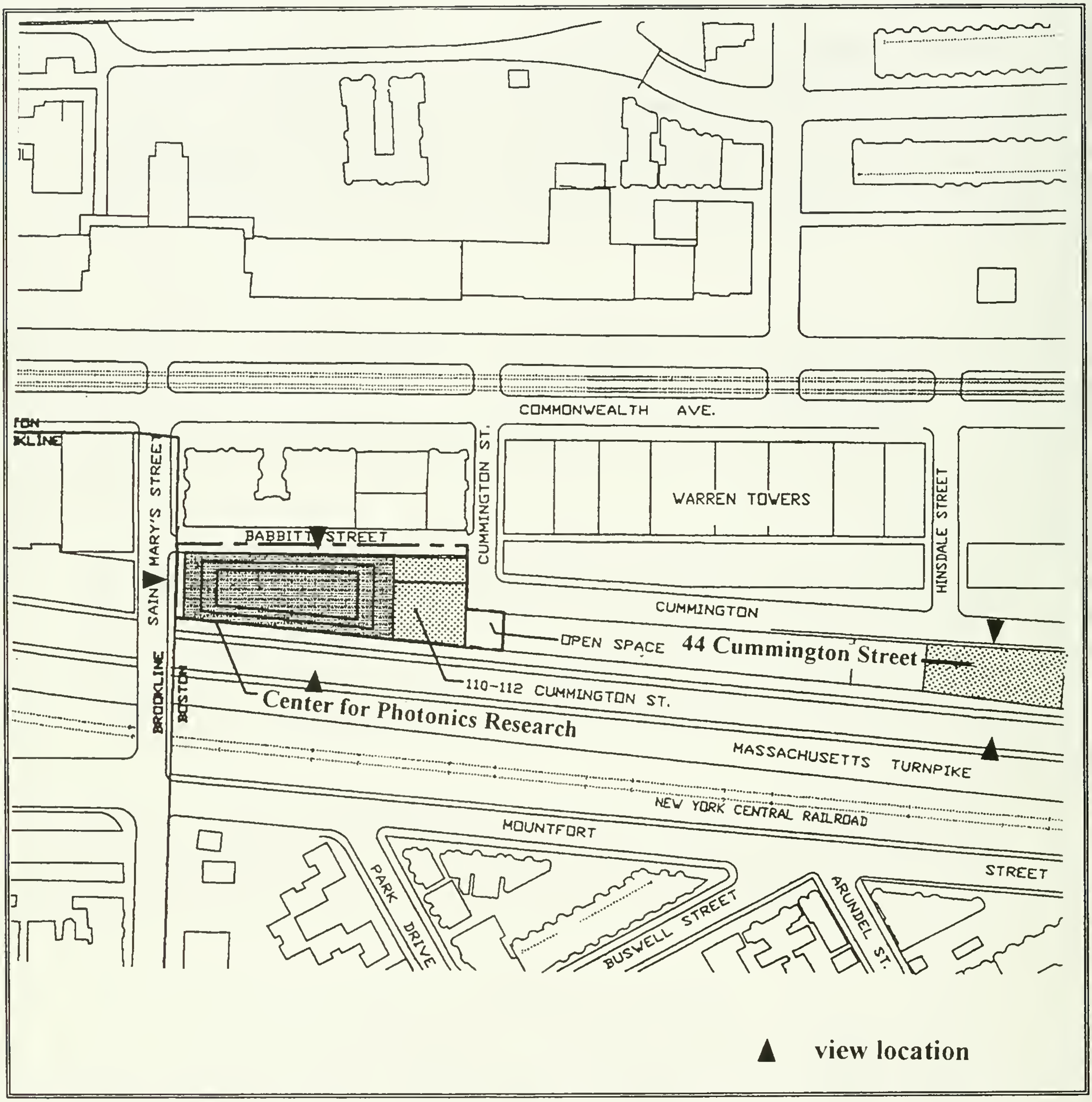
Daylight values for a hypothetical two-story would result in a value of 62.6 from Babbitt Street, 19.8 from the Massachusetts Turnpike, and 56.1 from St. Mary's street. These values are lower than the comparison building at 44 Cummington Street and the proposed Project. These values are also lower than what would be expected for typical academic buildings.

TABLE 6-1
Daylight Obstruction Values (BRADA)

	Center for Photonics Research	**44 Cummington Street**	**FAR 2.0 Building**
Mass. Turnpike	65.9	62.6	20.9
St. Mary's Street	86.2	N/A	56.1
Babbitt Street	92.0	N/A	62.7
Cummington Street	N/A	83.9	N/A

6.4 CONCLUSION

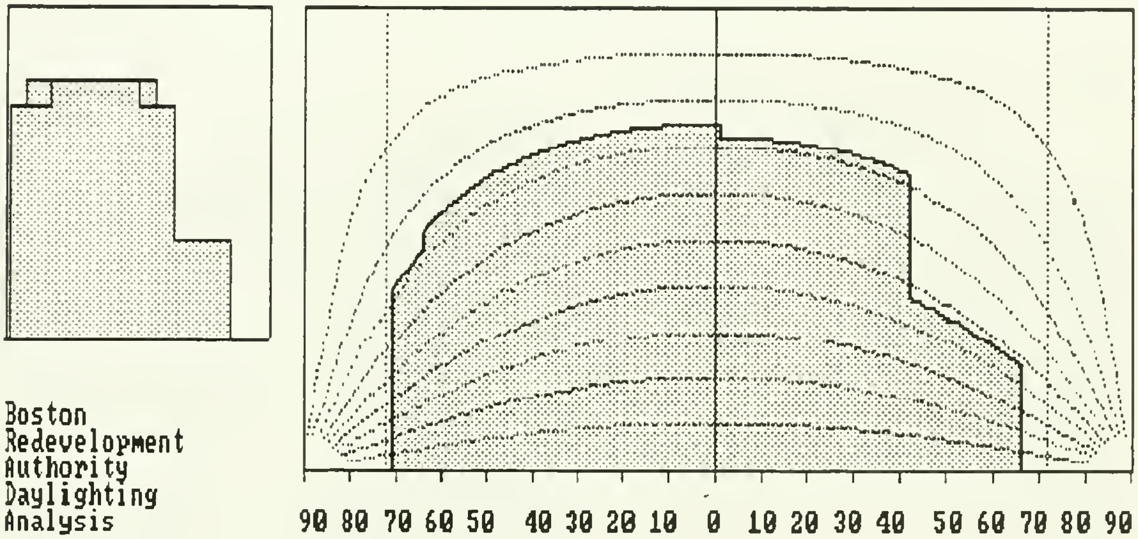
Daylight values for the Center for Photonics Research project from the Turnpike and St. Mary's Street will be consistent with the values for the existing science and engineering buildings in the area. On Babbitt Street, a narrow private alley, the values will be higher than typically found on public streets. The daylight values from the Project will, however, be higher than values resulting from a hypothetical building with a FAR of 2.0 reflecting the existing M-2 zoning.



Daylight View Orientation Plan

Prepared By:
Fort Point Associates

Figure 6-1



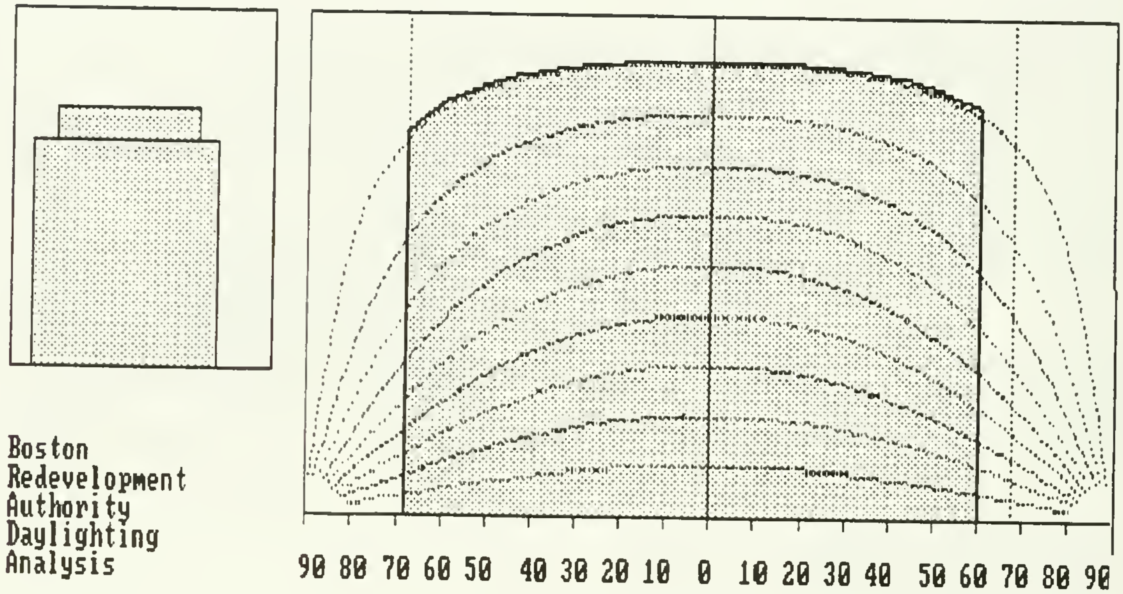
Adjusted daylight obstruction is 65.9 %

Proposed Photonics Building Massachusetts
Pike Perspective

Center for Photonics Research- Massachusetts Turnpike

Prepared By:
Fort Point Associates

Figure 6-2



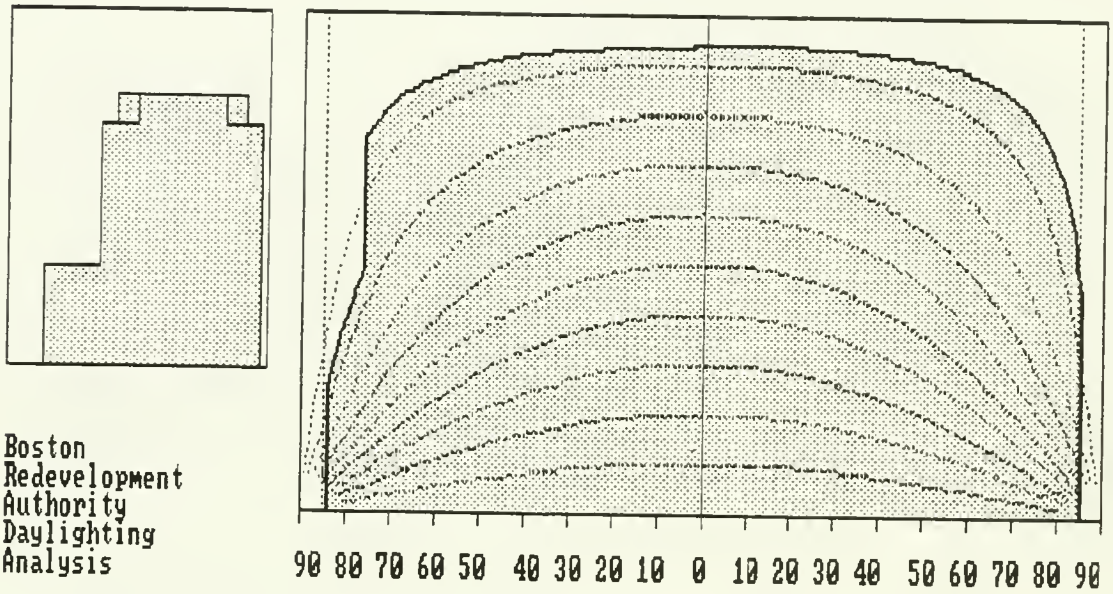
Adjusted daylight obstruction is 86.2 %

St. Mary's St. Perspective

Center for Photonics Research - St. Mary's Street

Prepared By:
Fort Point Associates

Figure 6-3



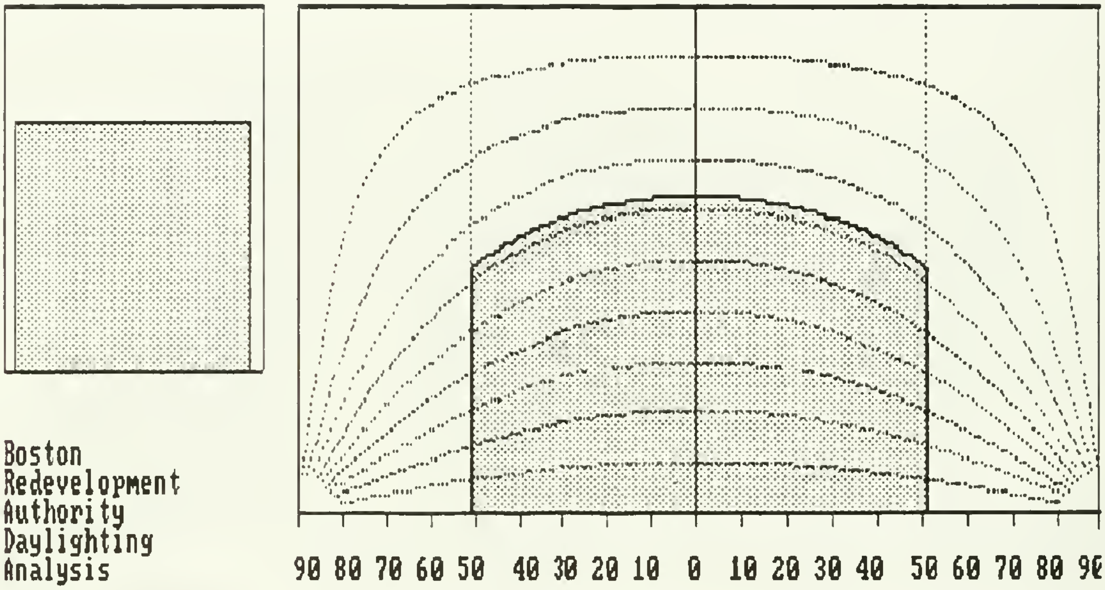
Adjusted daylight obstruction is 92.0 %

Babbit st. Perspective

Center for Photonics Research - Babbitt Street

Prepared By:
Fort Point Associates

Figure 6-4



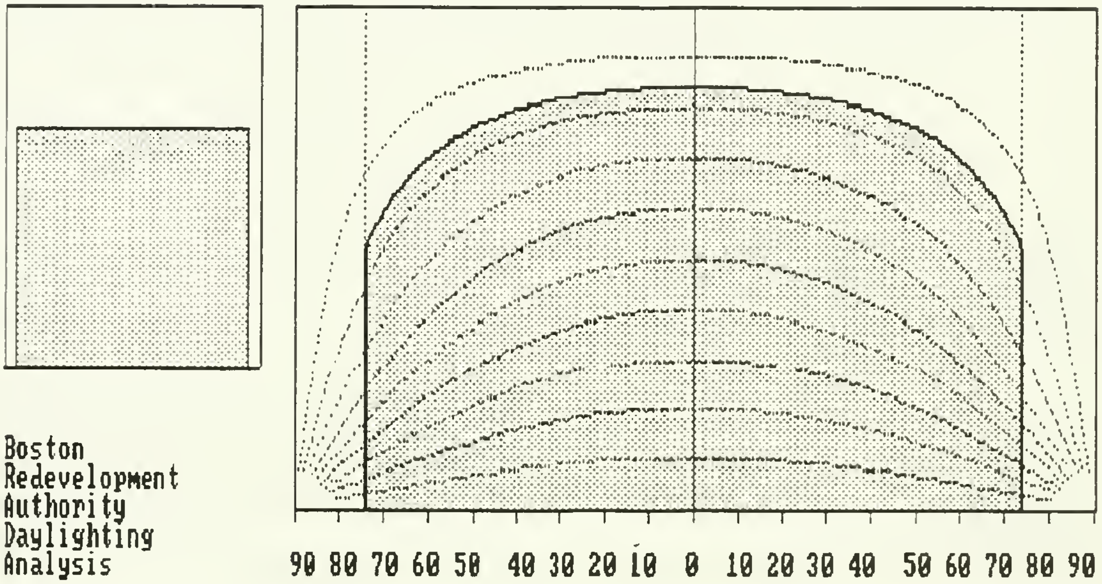
Adjusted daylight obstruction is 62.6 %

44 Cummington Massachusetts Pike Perspective

44 Cummington Street - Massachusetts Turnpike

Prepared By:
Fort Point Associates

Figure 6-5

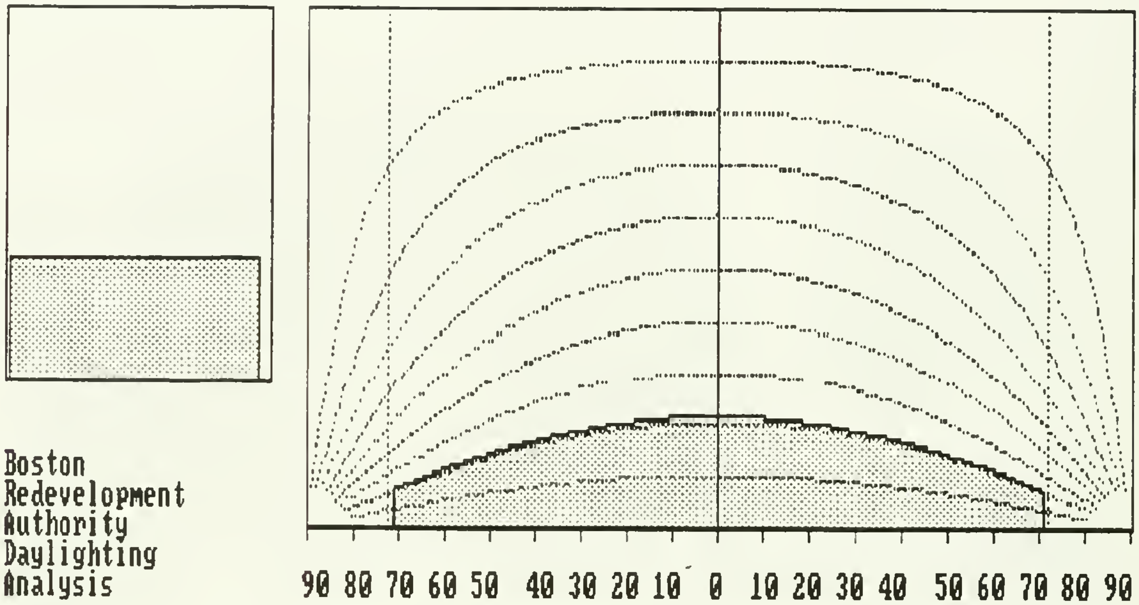


Adjusted daylight obstruction is 83.9 %
44 Cummington Ave.

44 Cummington Street - Cummington Street

Prepared By:
Fort Point Associates

Figure 6-6



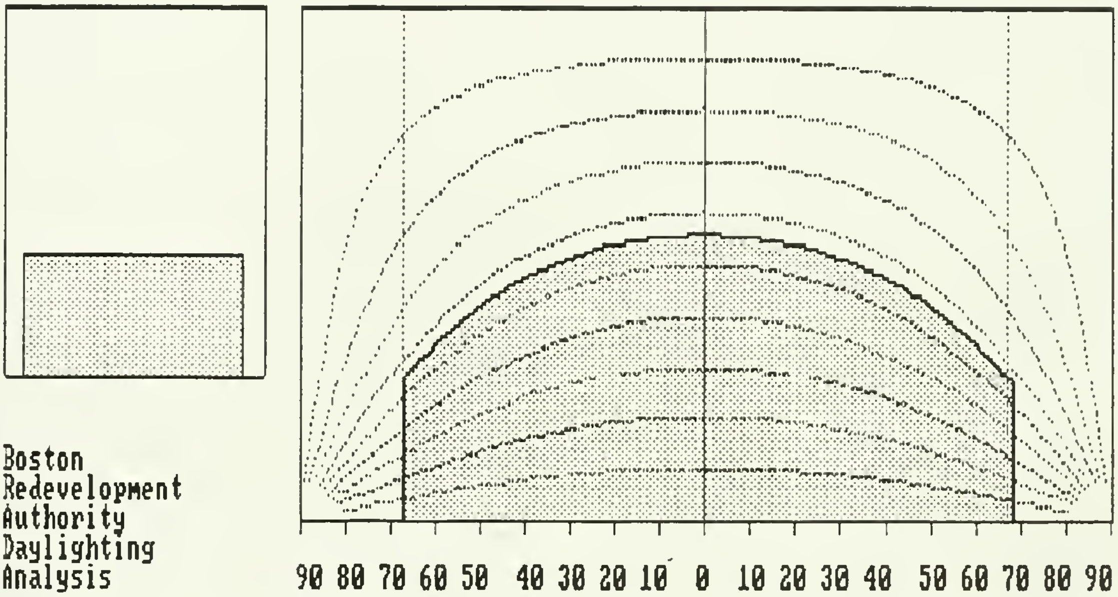
Adjusted daylight obstruction is 20.9 %

2 Story Full Build Out on Sight

FAR 2.0 Building - Massachusetts Turnpike

Prepared By:
Fort Point Associates

Figure 6-7



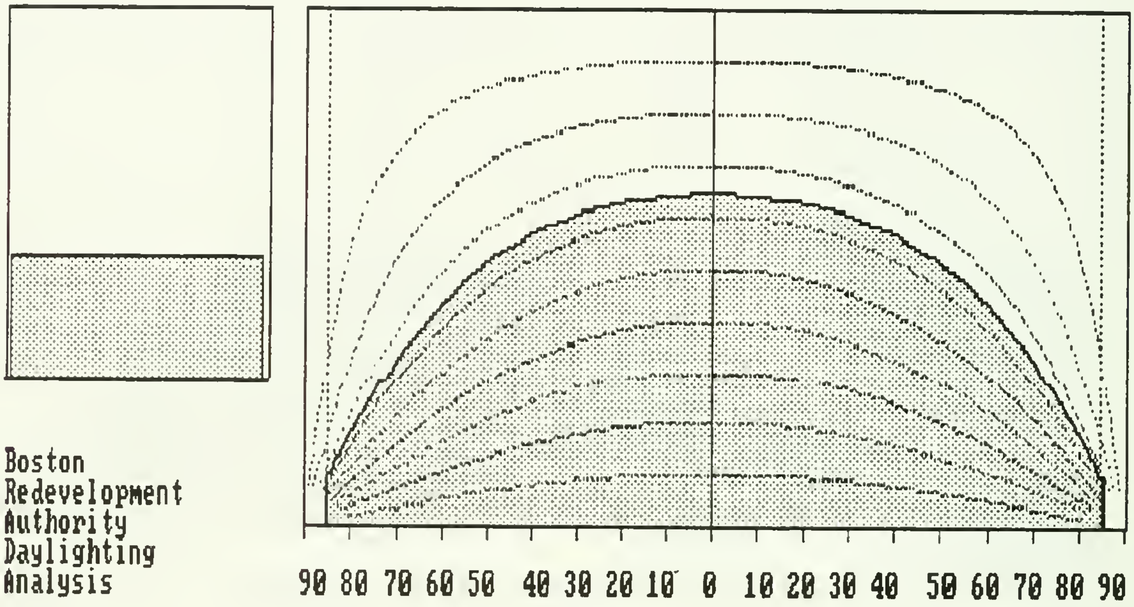
Adjusted daylight obstruction is 56.1 %

St.Mary's St. Perspective With 2 Story Buildout

FAR 2.0 Building - St. Mary's Street

Prepared By:
Fort Point Associates

Figure 6-8



Adjusted daylight obstruction is 62.7 %

Babbit St. Perspective With 2 Story Buildout

FAR 2.0 Building- Babbitt Street

Prepared By:
Fort Point Associates

Figure 6-9

7.0 AIR QUALITY

7.0 AIR QUALITY

7.1 INTRODUCTION

The majority of program space in the new Center for Photonics Research building will be utilized for laboratory and associated support functions. The laboratory floors will be devoted to Photonics research which encompasses a variety of disciplines (see Chapter 2.0, Project Description) and also electronic and computer related engineering research. Laboratory spaces will occupy all or portions or each floor from basement up to the eight floor. The building mechanical and electrical spaces are consolidated in partial basement areas and in the penthouse levels of the building. Boston University's Safety Office has drafted guidelines for handling of materials and chemicals in laboratories which will minimize potential air emissions problems. Central air conditioning and hood exhaust systems will be located at the penthouse level and will serve all occupied spaces of the building including laboratory, office and classroom uses. The central boiler plant will also be located in the penthouse level mechanical room.

A wind intake/exhaust test of the major building intakes and exhausts will be performed to identify potential impacts on the new Research Center building as well as on neighboring buildings on and off site to ensure complete emission safety levels are maintained. It is anticipated that the Project will require Comprehensive Plan approval from the Massachusetts Department of Environmental Protection for the boiler plant.

7.2 OPERATIONS

Ventilation and Air Conditioning Exhausts

The air conditioning systems will be served by four large central air handling units each with air intakes located centrally at the penthouse level facing north from Babbitt Street. The penthouse level is located over 160 feet above average grade level. The intakes are located on the north side of the penthouse, the most remote location from the Massachusetts Turnpike (see Figure 7-1). No adverse effects are anticipated from the vehicular traffic on the Turnpike due to height and orientation of the vents. Each half of the building, east and west, will be supplied by two units, with the main supply ducts connected for a combined distribution network. Each air handling unit will be divided into two compartments to allow each half to operate independently. Therefore, if one half of either unit is inoperative for malfunction or maintenance, a minimum of 75 percent capacity is still available to maintain the indoor air quality level.

In accordance with the American National Safety Institute (ANSI) standards, the laboratory space will have a high capacity exhaust system requiring greater air and heating capacity than a typical building. Maximum return air will be utilized to reduce energy use. Air from the biomedical and chemistry laboratories and all fume hoods will be exhausted from the building. A manifolded exhaust system will be used which will assist in dilution of any airborne chemicals. The central exhaust system will incorporate four fume hood exhaust fans and shall be designed for a maximum of three operating to allow for one as a stand-by unit. Any specialty hoods defined during the laboratory programming for the building, will be provided with a separate dedicated exhaust system. Each central exhaust fan will discharge independently through the upper penthouse level roof. The discharge will be vertical, 10 feet above the roof, with a constant volume and constant velocity of 4,000 feet per minute for further dilution and dispersion. The stacks are set back away from air intake vents. The dedicated exhaust systems will have similar discharge criteria. We anticipate the exhaust stack locations at the top level of the building, will present no safety hazard for the pedestrians at street level. No exhaust systems at ground level are contemplated.

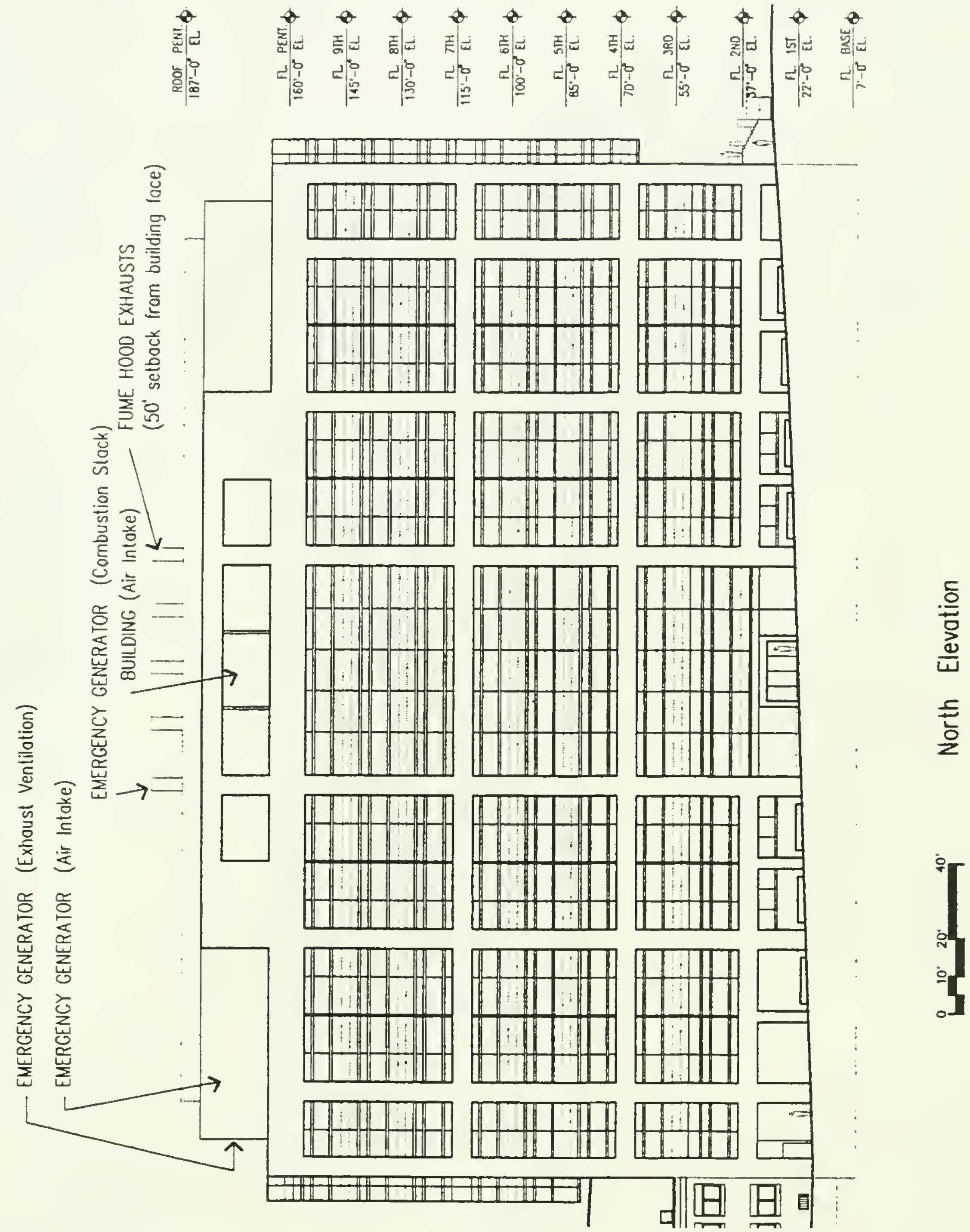
The existing laboratory exhaust fans located on the roof of the 110-112 Cummington Street building are not anticipated to have an impact on the Research Center but will be included in the wind intake/exhaust test study to confirm safety standards. The external air conditioning units currently on top of the building will be removed because the new systems in the Research Center are designed to backfeed the building.

Boiler Exhausts

A central steam generating plant will be included to serve the building needs for space heating, preheating of ventilation air, humidification and process steam for the laboratories. The steam plant will be located at the penthouse floor level and shall consist of three (3) fire tube type steam boilers -- two for operation and one for standby. Each boiler will have a capacity of 350 boiler house power and shall have combination burners suitable for firing with both natural gas and #2 fuel oil. At this time, it is expected that natural gas will be the primary fuel. Each boiler breeching will be manifolded with a single exhaust stack exhausting vertically through the upper penthouse roof level. Specifications for the boilers and burners will reflect the Best Available Control Technology and ensure the installation meets the emission levels governed by the Massachusetts Department of Environmental Protection and Boston Air Pollution Control Standards. The boiler system is sized to serve the 110-112 Cummington Street building in addition to the Research Center. The new system will backfeed the adjacent building essentially replacing the existing oil burning system which is estimated to be over 30 years old.

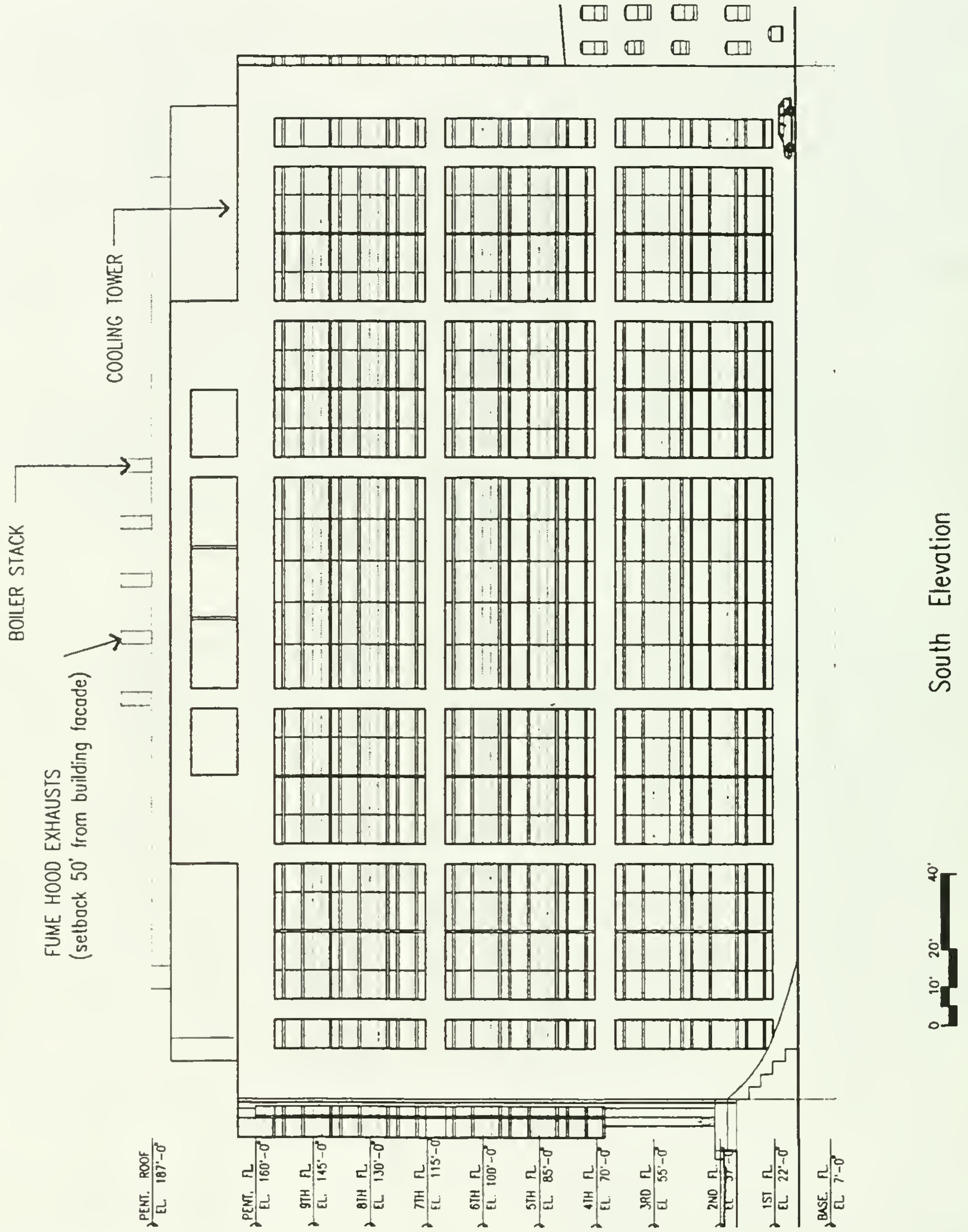
7.3 CONCLUSION

The design for the ventilation and exhaust systems will include operating features and controls to ensure the safety of staff and students of the Research Center building and residents of the surrounding area. The heating system will also serve 110-112 Cummington Street replacing the old oil burning system with a much cleaner and efficient system. The boiler stack emissions will conform to the local and state requirements.



Location of Air Intake and Exhaust - North Elevation

Prepared By: Cannon	**Figure 7-1**



Location of Lab Exhausts and Boiler Stacks - South Elevation

Prepared By: Cannon

Figure 7-2

8.0 WATER QUALITY

8.0 WATER QUALITY

8.1 INTRODUCTION

This chapter discusses the type and handling of waste water associated with laboratory uses in the Center for Photonics Research project. Activities in 110-112 Cummington Street will not change as a result of the Project. The laboratory waste systems are designed in accordance the Massachusetts Plumbing Code and to meet the MWRA requirements. The new Research Center project will be included under the University's industrial user permit for discharge of sanitary wastes. The University is currently working with MWRA officials to establish a permit which will cover all activities on campus including the Research Center.

The wastes associated with the Project will be subject to Boston University Safety Office procedures along with other science, engineering, and medical facilities on campus. All research activities will be conducted in strict accordance with all OSHA standards and applicable licenses, permits, and industry standards.

8.2 OPERATIONS

The majority of laboratories in the new Research Center are designed for optical, electronic and computer related activities. These "dry" type laboratories do not have unusual water demands and will not require special handling or treatment. A portion of the laboratories in the new building will be used for chemistry and biomedical research activities. These "wet" type laboratories often generate special water wastes which warrant attention. The sanitary sewer system for the new building is designed to handle the laboratory waste water discharge by employing acid-resistant materials. Procedures for mercury capture will be implemented to prevent mercury from discharging into the sewer system. Photographic darkrooms will be equipped with cartridges for silver recovery. These cartridges are handled and replaced by the vendor as part of the service contract.

The laboratory waste water system will be equipped with an automated acid neutralizing system which includes a pH analyzer with recorder and alarm, mixing tank, caustic tank with a meter fed pump, neutralizing tank, and effluent monitor. All laboratory waste water will be subject to monitoring and treatment (neutralization) prior to discharge into the municipal system.

Draft guidelines on chemical safety for the Research Center have been developed (See Appendix C). These guidelines present a chemical safety program which addresses procedures handling of hazardous materials associated with research activities anticipated in the building including:

- Basic chemical handling procedures - material safety data sheets and logs, labeling and special handling requirements, proper storage by hazard classes, and spill control programs.

- Educational programs - hazard communication and chemical safety training.
- Chemical waste disposal procedures - disposal of chemicals, disposal of hazardous wastes, and chemical inactivation and reclamation.
- Employee and employer rights and responsibilities.

8.3 CONCLUSION

The Center for Photonics Research project will not compromise water quality. All research activities conducted will be properly licensed and permitted. The Research Center will have safety guidelines developed for anticipated activities and will also be subject to University safety procedures similar to other research facilities on campus. The laboratories and associated mechanical systems are designed for monitoring and treatment which will prevent any inappropriate discharges from the building. No wastes will enter into the municipal system that do not strictly conform with BWSC and/or MWRA standards.

9.0 SOLID AND HAZARDOUS WASTES

9.0 SOLID AND HAZARDOUS WASTES

9.1 INTRODUCTION

This chapter describes the solid and hazardous wastes associated with the Center for Photonics Research project. A site history has been conducted for the site and is discussed. Further testing of subsurface soils and groundwater conditions is currently in progress. The Project is not expected to involve extensive excavation for the foundation. However, prior to commencement of construction, a comprehensive handling and disposal plan for demolition debris, excavated soils and groundwater treatment will be developed.

The operation of the new Research Center will involve ordinary and special wastes. The Boston University Safety Office oversees the handling of special wastes associated with science and engineering research. Furthermore, all research activities will be conducted in strict accordance with all applicable licenses, permits, and regulations.

9.2 EXISTING CONDITIONS

The proposed building is located at the corner of Babbitt and St. Mary's Streets and bordered by the Massachusetts Turnpike on the south side. There are three one- and two-story brick structures with basements at the site which will be demolished to make way for the proposed structure. Existing basement floor elevations are at about El. 10 for 18-22 Babbitt Street to about El. 20 for 8 St. Mary's Street. The structures at 110-112 Cummington Street will remain on site.

The ground surface varies between about El. 17 and El. 28 on the Babbitt Street side, and drops to about El. 14 on the Turnpike side of the site. Along St. Mary's Street, the existing ground rises from about El. 28 to about El. 35 at the bridge over the Turnpike. Also, along the St. Mary's Street side of the site, there is a 5 1/2-foot-diameter MWRA storm sewer, with the invert at about El. -1.6. The centerline of the sewer is located about 9 feet from the face of 8 Saint Mary's Street (See Figure 9-1).

9.3 HISTORY OF OIL AND HAZARDOUS MATERIALS

The site history presented below is summarized from reports prepared by GZA GeoEnvironmental, Inc. (1992) (GZA) of Newton, Massachusetts and McPhail Associates Inc. (1982) of Cambridge, Massachusetts.

At the site of the existing 18-22 Babbitt Street, a previous one-story, masonry structure existed, with a vacant lot between it and 110-112 Cummington Street. A large dish-type communications antenna is located at the south side of the building, adjacent to the Turnpike. The previous structure at 18-22 Babbitt Street was used for a number of uses including a garage and for automotive repair from 1914 to at least 1951 and in 1964 appears to have been the location of a sheet metal works facility. In 1982, the vacant lot was being used both for parking and as a location for the dish-type communications antenna.

The current structure at 8 St. Mary's Street (also known as the "elevator" building) was constructed in 1917 and replaced a previous residential structure. The current structure was occupied by Wagner Electric Corporation between 1932 to 1937, H.G. Davis Automobile Service from between 1937 to 1960 and by the Beckwith Elevator and Lift Company between 1960 to 1978. During part of this period, Pappas Auto Technology was also located at the site. The most recent tenant was Metropolitan Parking Services Inc., who took occupancy in 1978.

The property to the north of Babbitt Street has been residential since at least 1914. Sanborn maps indicate that Babbitt Street had been part of Cummington Street until sometime between 1951 and 1964, when it was renamed.

There appear to be two oil tanks present. One is an above ground tank of about 750 gallon capacity located in a boiler room at the southeast corner of 8 St. Mary's Street. The room has stone/concrete walls and a concrete floor. No floor drains were observed. The other oil tank is below ground, and is located at the southwest corner of 22 Babbitt Street. Pipes to fill these tanks are located in the alley way between 8 St. Mary's Street and 22 Babbitt Street.

The previous use of the middle portion of the site, as described in the site history prepared by GZA, indicates the possibility that solvents may have been used. In order to characterize the soil beneath the existing buildings at the site, and the ground water, GEI will be testing soil and water samples obtained from directly beneath the existing structures, as described in Sections 9.4.2 and 9.4.3.

9.4 CONSTRUCTION DISPOSAL PLAN

9.4.1 DEMOLITION

All containers of hazardous materials and other hazardous building components will be removed in advance of demolition and disposed of in accordance with applicable regulations. All non-hazardous demolition debris will be disposed off-site at a licensed landfill.

Any buried or interior (above ground) oil tanks will be cleaned and removed off-site in accordance with applicable regulations. Any concrete or soil contaminated with oil will be removed and disposed of at a licensed facility.

It is believed that the building at 8 St. Mary's Street contains vinyl asbestos and asbestos pipe lagging. Prior to demolition a complete asbestos survey will be conducted of all structures slated for demolition and an asbestos abatement plan will be developed. All asbestos containing building materials will be removed from the structures by a licensed contractor prior to demolition.

9.4.2 SOILS

GZA's environmental site evaluation of the 8 St. Mary's Street property (west portion of the proposed Center for Photonics Research site) indicated that there were low levels of several petroleum constituents and of a single solvent in the soil at the site. The contaminant levels in the soil were below those that would require notification to the Massachusetts Department of Environmental Protection (DEP) under the Department's Draft Notification Regulations.

GEI has been engaged by the University to characterize the soil to develop a Soil Management Plan. The objective of the plan is to determine in advance of construction which methods of disposing excavated soil are required to conform with the Massachusetts Contingency Plan (MCP) regulations (310 CMR 40.0000) and, if necessary, Massachusetts Hazardous Waste Regulations (310 CMR 30.000). Eight borings will be drilled from within the basements of the existing buildings. Four of the borings will be within the footprint of 8 St. Mary's Street and will be about 20 feet deep. The remaining four borings will be about 8 feet deep, with two borings located in 16 Babbitt Street and two borings in 22 Babbitt Street. A monitoring well will be installed in the boring nearest St. Mary's Street to supplement the 3 existing wells. The planned sampling locations are shown on Figure 9-1.

Soil samples will be collected from the borings and screened on site for the presence of volatile organic compounds (VOCs). Two composite samples, one for the upper ten feet and the other for the lower ten feet, will be taken for each of the borings within 8 St. Mary's Street. One composite sample will be taken for each of the borings in 16 and 22 Babbitt Street.

The soil will be submitted to a DEP approved laboratory for analysis to evaluate the chemical constituents required to characterize the soil for disposal:

Soil Analyses

Test	No. of Samples
TPH by IR	12
VOCs by 8240	12
PCBs	12
As/Cd/Cr/Hg/Pb	12
TCLP Lead	12
PAH	12
Conductivity	12
Reactivity	12
Ignitability	12

If the soil is clean, the contractor may be allowed to reuse the soil as backfill on-site and/or as off-site fill at an appropriate urban construction site. If there is contamination, contaminant concentrations will be compared with applicable MCP Reportable Concentrations and method 1 clean-up standards. Test results will also be compared to other applicable state (310 CMR 30.000) and federal regulations for identifications of wastes which are characteristically hazardous.

The testing program will provide enough information to determine if the soil can be reused in a lined landfill as cover material, recycled at an asphalt batching plant, or needs to be disposed of as hazardous waste material in a licensed lined landfill or Resource Conservation Recovery Act (RCRA) facility. This determination will be made by a Licensed Site Professional (LSP) as required under the MCP.

9.4.3 GROUNDWATER

Very low levels (below method detection limit) of tetrachloroethene (TCE) were found in a ground water sample from one of three previously installed monitoring wells installed at the site as part of the GZA study. GEI has been engaged by Boston University to further characterize the groundwater in order to develop a suitable dewatering disposal plan. The objective of the plan is to determine, in advance of construction, suitable methods for excavation groundwater disposal.

The characterization program will be directed by a LSP and consists of taking water samples from each of the four on-site wells (three existing wells and one new well.) The water will be submitted to the laboratory for analysis to evaluate typical disposal characterization criteria. Proposed analyses are as listed below. Laboratory detection limits will be set at concentrations consistent with MCP regulations. The frequency of testing for water during construction will depend upon the volume of water pumped out of the excavation.

Water Analyses

Test	No. of Samples
Priority Pollutant Metals	4
Boron	4
Chromium (hexavalent)	4
PCBs	4
Pesticides (Methods 8080 & 8140)	1
VOCs (Method 624)	4
Semi-VOCs (Method 625)	4
Petroleum Hydrocarbons (IR)	4
pH	4
Total Fats/Oil/Grease (gravimetric)	4

At present it is anticipated that the water can be disposed of in a storm drain with permits from the Boston Water and Sewer Commission and/or the Massachusetts Water Resource Authority as appropriate. All ground water will be routed through sedimentation tanks before discharge into the drain.

If the results of the testing indicate the presence of oil and hazardous materials a level that would preclude disposal in a drain, then the water disposal plan will address requirements for on-site treatment prior to disposal in a sewer, or if this is not feasible the plan will address requirements for off-site treatment and disposal of the ground water or its reinjection into the ground.

9.5 BUILDING OPERATIONS

9.5.1 SOLID WASTES

The Research Center is designed to accommodate recycling and participates in the recycling program instituted by the University throughout the campus.

There will be two methods of waste disposal in the new building to handle standard trash removal (non recyclable) and recyclable materials. A trash compactor will be housed in the loading dock of the building. This compactor will store all of the non-recyclable trash coming from the building. The compactor will be emptied as necessary by the contracted service on campus.

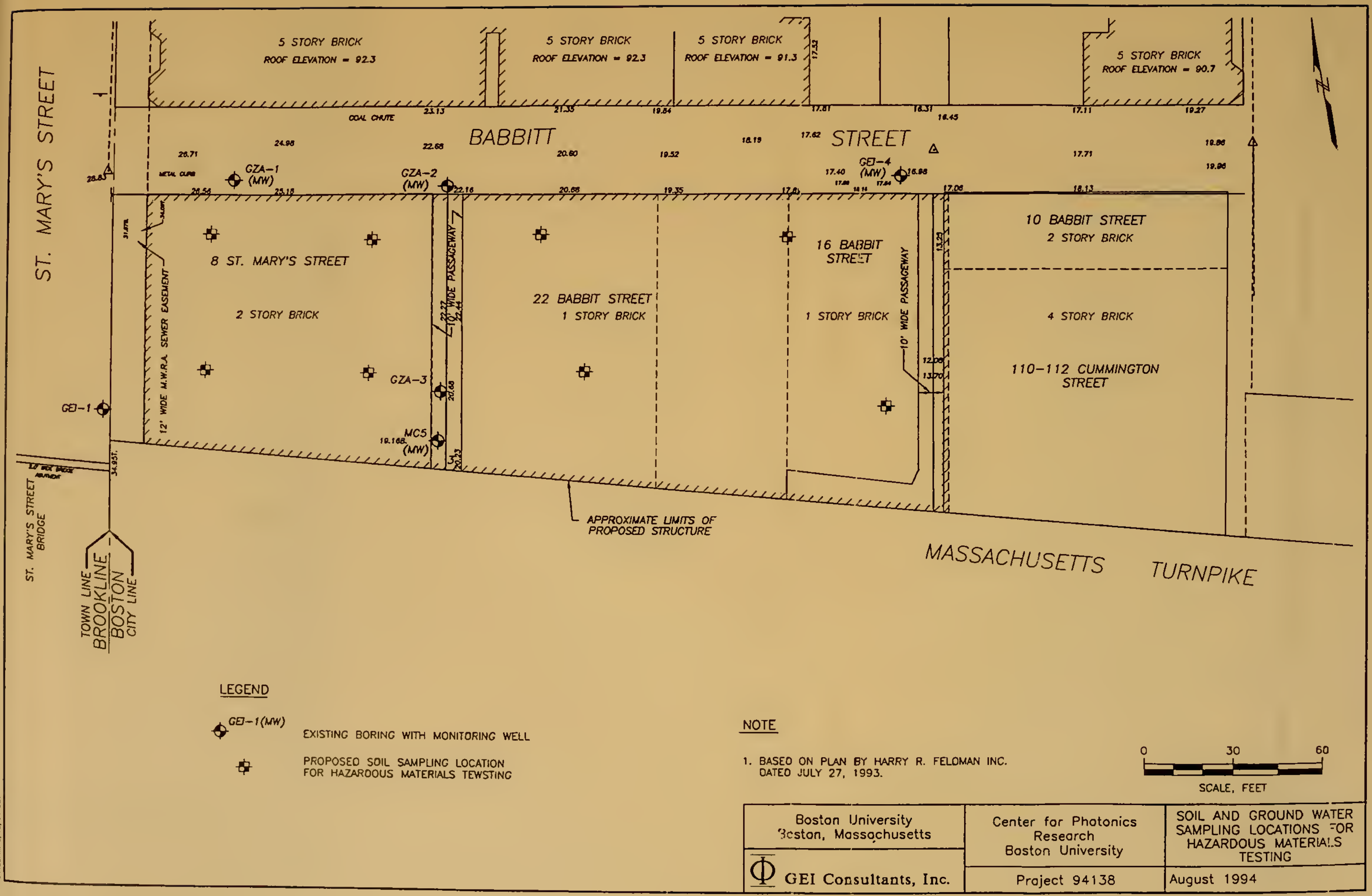
One recycling room will be located on each floor. Each room will house six recycling bins for the collection of recyclable materials: paper, newspaper, cans, bottles, plastic and other materials such as styrofoam cups. These bins will be taken to the loading dock regularly to be handled by the contracted service on campus. Recycling locations are shown in Figure 9-2.

9.5.2 SPECIAL WASTES

The Center for Photonics Research can be expected to generate wastes consistent with other similar research activities on campus which will require special handling. A safety guideline manual will be established specifically for the Research Center which will address the labeling, logging, handling, and disposal of any hazardous materials. Designated containers for special wastes are provided in laboratories where such materials are used and will be handled as part of the University waste management program. Special wastes will be collected by Boston University Safety Office personnel on an as-needed basis and removed from campus by contracted licensed haulers. Additional discussion of the safety guidelines may be found in Chapter 8.0, Water Quality. Draft guidelines on chemical safety are provided in Appendix C.

9.6 CONCLUSION

The Research Center will be subject to all safety procedures issued by the Boston University Safety Office. All wastes will be handled in accordance with Occupational Safety and Health Act (OSHA) standards and applicable licenses, permits, and industry standards. The University requires that all research conducted in the building comply with all local, state, and federal regulations, statutes regarding the use of any hazardous substances and/or wastes in the building. The University will monitor company-based research activities to assure that no programs are less stringent than the University's safety programs.



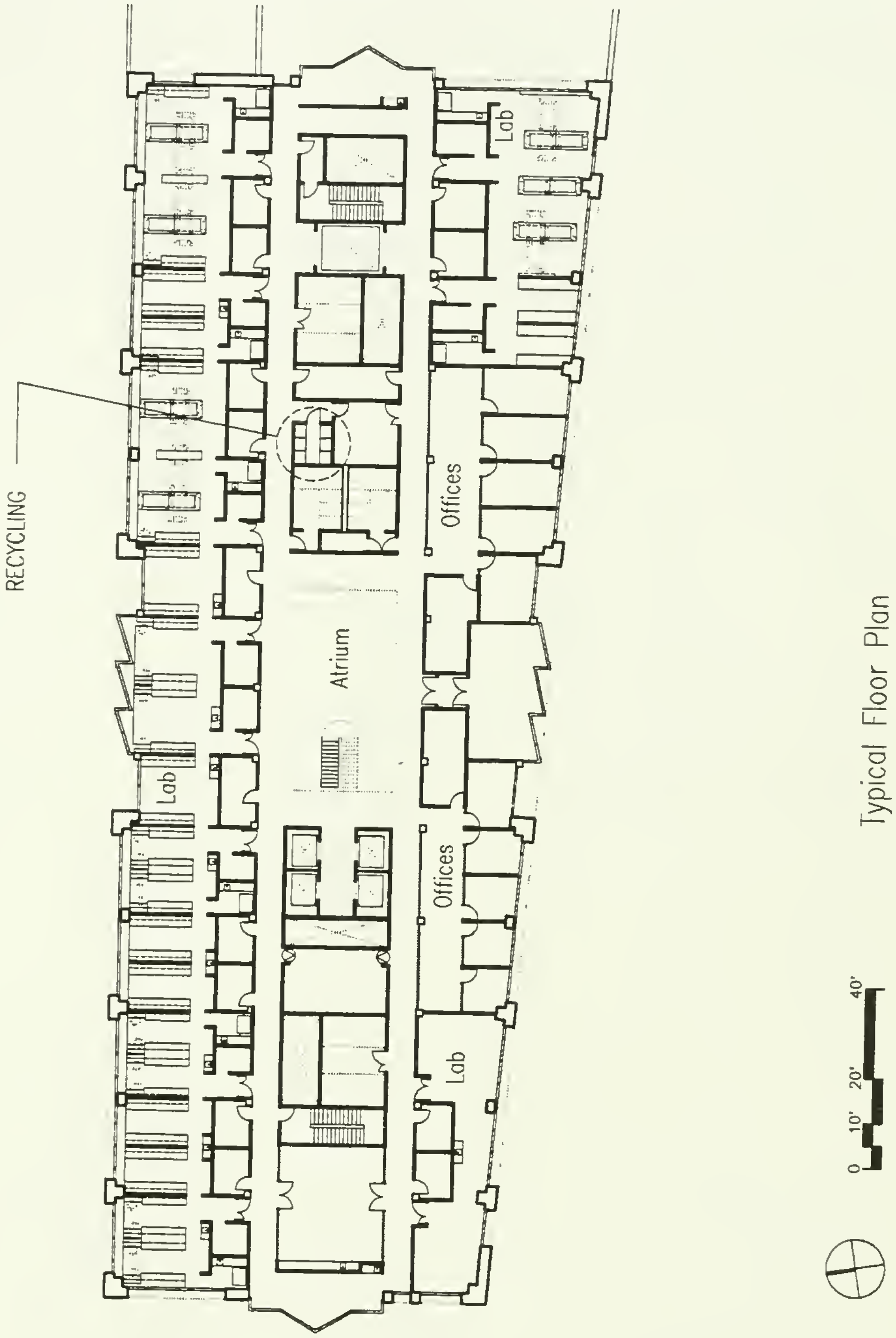
BOSTON UNIVERSITY

Center for Photonics Research

Soil and Groundwater Sampling Locations for Hazardous Materials Testing

Figure 9-1

Prepared By:
GEI Consultants Inc.
August 1994



Recycling Areas

Prepared By:
Cannon

Figure 9-2

10.0 NOISE AND VIBRATION

10.0 NOISE AND VIBRATION

10.1 INTRODUCTION

This chapter addresses potential impacts from the Center for Photonics Research project relating to noise and vibration during and after construction. The University is the owner of almost all abutting and adjacent buildings to the site and, therefore, is particularly concerned about minimizing short-term and permanent impacts. Furthermore, there are significant utility and infrastructure systems in the vicinity which will be given special consideration during construction.

The Project site is located in an urban area with high ambient noise levels largely associated with traffic on Commonwealth Avenue and on the Massachusetts Turnpike. The University owns and occupies the residential structures abutting Babbitt Street and will minimize permanent noise impacts on these properties as much as possible.

No unusual issues are anticipated for construction or with the exterior mechanical systems. The University will strictly comply with the Regulations for the Control of Noise in the City of Boston. Furthermore, the new Research Center will include optical laboratories. The building, therefore, incorporates special structural design features which isolate laboratories containing vibration-sensitive equipment.

10.2 BUILDING SYSTEMS

The new Research Center will contain mechanical systems which have the potential to generate exterior noise in the area. Exterior mechanical equipment is located in the mechanical penthouse over 160 feet above average grade and approximately 100 feet above the residential buildings abutting Babbitt Street.

Cooling Towers

A total of three cooling towers will be used for the building air conditioning and the laboratory process cooling system. The towers will be located in an enclosed roof area of the penthouse floor level. The cooling tower enclosure will be on the southeast corner of the building facing the Turnpike and Cummington Street. The tower location, being away from residences, will assist in providing attenuation of potential noise. The specifications for the cooling towers will assure that acceptable noise levels for the nearby sensitive receptors within the surrounding areas are achieved.

Ventilating and Air Conditioning Systems

The air handling units serving the HVAC systems will be located in the mechanical penthouse with the intake vents facing north towards Babbitt Street. Noise attenuators will be included in the ductwork connections to reduce any fan noise emanating from the building.

The 110-112 Cummington Street building is presently served by two packaged type air conditioning units mounted on a steel structure above the roof level. Each unit includes electric driven cooling components including compressors and evaporator fans as part of the unit. Each unit has a nominal capacity of 75 tons. The design of the Research Center systems include the capacity within the equipment and duct work to backfeed to the 110-112 Cummington Street building. It is anticipated these existing noisy units will be removed when the Research Center is operational.

Hood Exhaust System

A total of four exhaust fans will serve the manifold exhaust system of the new building with a maximum of three operational with one as standby. The fans will be centrally located within the upper level of the mechanical penthouse away from the intake vents. Each fan is equipped with an independent panel enclosure. The paneling and ductwork will be attenuated to limit the sound levels to the building exterior.

The 110-112 Cummington Street building has a multiple of individual dedicated hood exhaust fans located at the roof level. It is anticipated at this time, that no modification will occur to these systems and fans.

Emergency Power Generation

The emergency power system will be served by a single 1,000 KW diesel driven emergency generator located in the northeast corner of the mechanical penthouse floor. The combustion air will be vented vertically up through the upper mechanical penthouse roof level. The operating use of the generator is limited to short periods for emergency only. The required tests will be performed during the normal working hours to minimize the impact to the adjacent area.

Structural/Vibration Controls

The complete building structure, including the foundation system, will be designed to isolate any external vibration from the Massachusetts Turnpike, railroad, and 110-112 Cummington Street. The optical laboratories where vibration-sensitive laser equipment will be used, will be further isolated from the building structure by use of isolation optical benches.

All vibrating equipment associated with the building systems will be analyzed for its impact internally to the building. The specifications will include for all necessary vibration isolation and supports for each piece of equipment to ensure vibration limits are maintained.

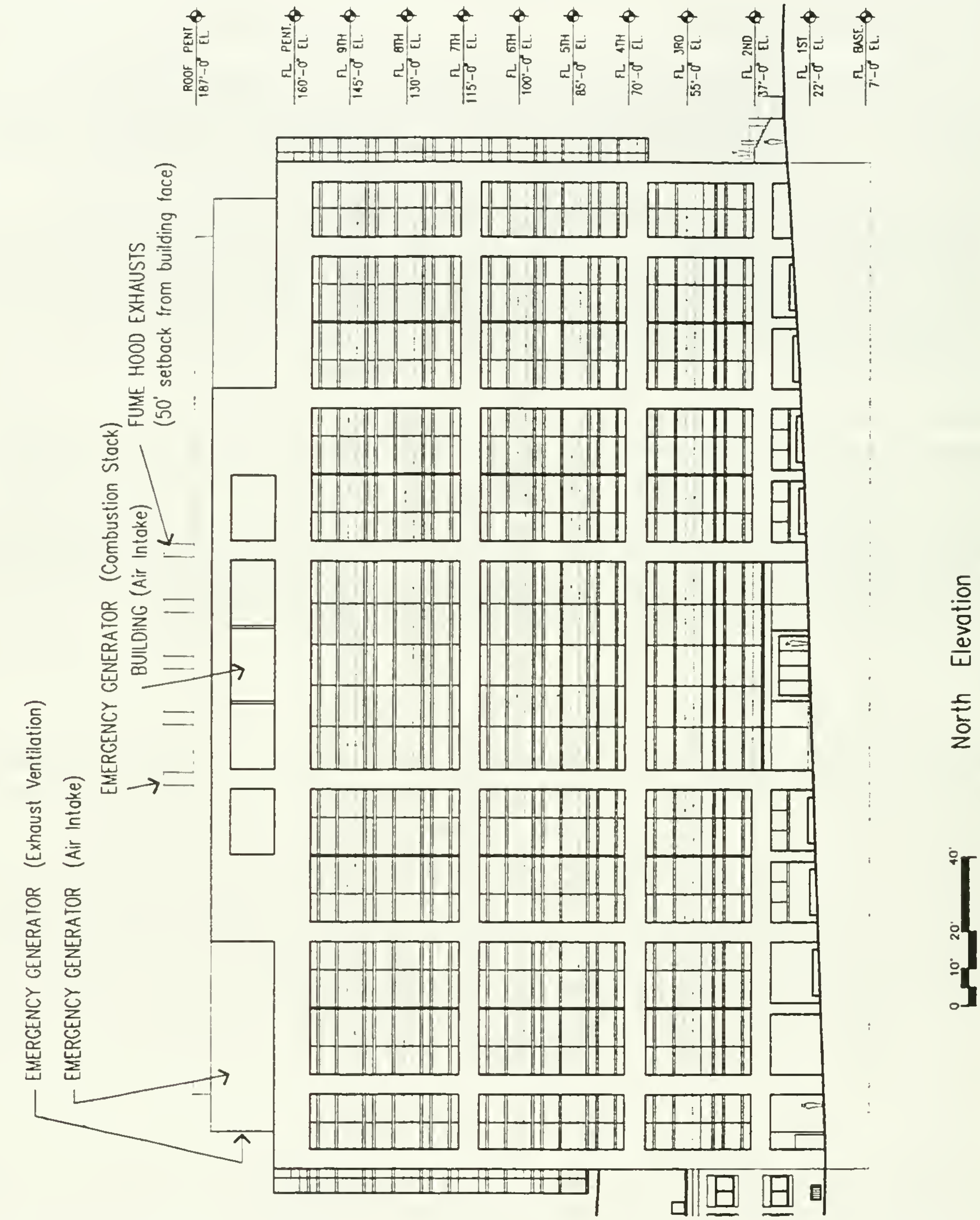
10.3 CONSTRUCTION

All construction work at the site must be performed in accordance with the Regulations for Control of Noise in the City of Boston. Furthermore, a Construction Management Plan will be prepared, approved by the Boston Transportation Department, and implemented during construction. Among other issues, this plan will stipulate protocols to be followed by the contractors in order to manage noise at the site. This plan will define construction hours, truck routes, procedures for the periodic inspection of mufflers to ensure their proper operating condition, and procedures for monitoring vibration during construction (most particularly during the site preparation and excavation phases). A more complete discussion of construction noise may be found in Chapter 15.0, Construction.

Vibration impacts during construction will be caused primarily by demolition of the existing structures, driving soldier piles or sheet piles for excavation support and compaction of backfill. At this time the selection of a foundation scheme has not been finalized. A mat foundation system and a pile foundation system are the two options being considered. If a pile foundation is used, installation of piles with impact driving also will be a cause of vibrations. The anticipated levels of vibration are not expected to cause structural damage to adjacent structures and utilities. Where warranted, piles will be pre-augured to minimize impacts on structures and utilities.

10.4 CONCLUSION

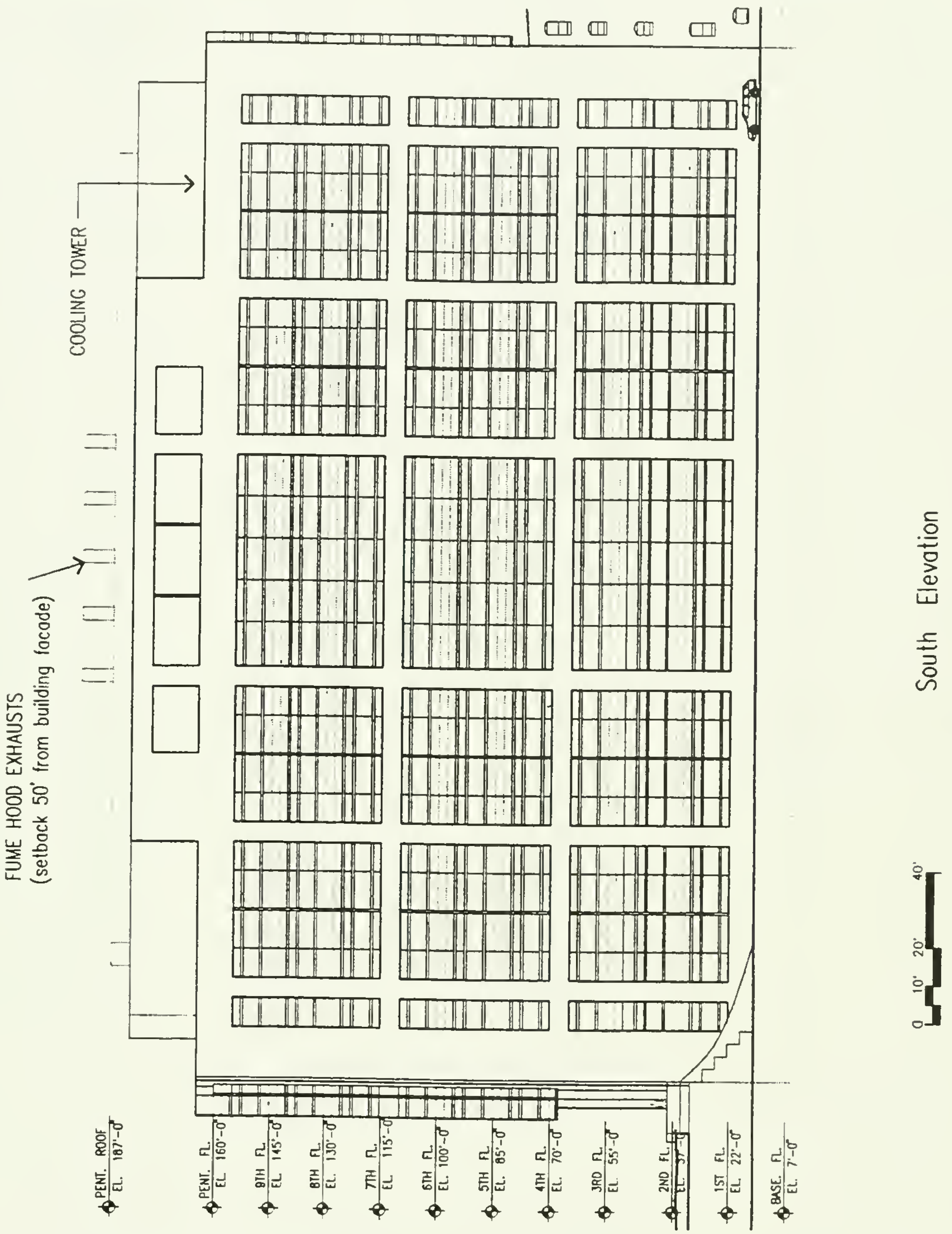
The Project will not create significant adverse noise and vibration impacts. The new Research Center is designed to protect sensitive receptors from potential noise impacts by locating exterior mechanical systems well above grade and above adjacent buildings. Where possible, noisy equipment is located away from residences. Where appropriate, noise attenuators will be provided. Construction activities will be planned in such a manner that adjacent structures and utilities will be protected and noise levels minimized. Building design considers and addresses requirements for vibration-sensitive equipment to be used in the new building. All applicable regulations regarding construction and operations will be strictly observed.



North Building Elevation

Prepared By:
Cannon

Figure 10-1



South Building Elevation

Prepared By:
Cannon

Figure 10-2

11.0 GEOTECHNICAL IMPACTS

11.0 GEOTECHNICAL IMPACTS

11.1 INTRODUCTION

This chapter summarizes subsurface conditions and discusses potential geotechnical impacts of construction on the existing soil and groundwater conditions, adjacent structures in the vicinity of the site such as 110-112 Cummington Street, the St. Mary's Street Bridge, St. Mary's Street, the MWRA sewer line, Babbitt Street, the Massachusetts Turnpike, and other buildings across Babbitt and across St. Mary's Street. Construction excavation requirements and methods are also described.

11.2 SUBSURFACE SOIL AND GROUNDWATER

Six borings ranging in depth from 46 feet to 150 feet were drilled at the locations shown on Figure 11-1 in the presence of an engineer. Both disturbed and undisturbed samples were obtained from the borings and tested in the laboratory. Information from these borings and from shallow borings performed earlier by GZA and McPhail Associates Inc. was used in evaluating foundation systems for the proposed building and also the geotechnical impact of the construction on the surrounding structures and utilities.

The soil conditions at the site are illustrated schematically in the subsurface profiles shown in Figures 11-2 and 11-3. The soil conditions are known only at the boring locations, and the soil conditions at other locations could vary significantly from those shown on the profiles.

Boring Results

General descriptions of the soil layers encountered in the borings are presented below. Beginning at the ground surface, the soils generally consisted of the following layers: a thin layer of asphalt or topsoil, loose to dense granular fill, medium dense to very dense sand and gravel, a stiff to soft gray clay, and dense to very dense silty sand. Bedrock was not encountered in any of the borings.

> **GRANULAR FILL** - The fill layer was 2 to 24 feet thick. The fill generally consisted of loose to dense fine sand with varying amounts of silt, gravel and occasional fragments of wood, cinders, and brick.
>
> **SAND AND GRAVEL** - A sand and gravel layer was encountered below the fill, and varied in thickness from about 45 feet at the southwest corner of the site to about 7 feet at the east end of the site. This layer generally consisted of medium dense to very dense widely graded silty sand, gravelly sand, and sandy gravel, grading with depth in some borings to silty fine sands. In the southwest corner of the site, this layer consisted of

interbedded sand and gravel, with narrowly graded sand and gravel layers appearing to alternate every few feet.

CLAY - A layer of gray, moderate to high plasticity silty clay was encountered below the sand and gravel in all of the borings except for boring GEI-1 at the southwest corner of the site. The upper 5 to 10 feet of the clay layer was interbedded with fine sand and silt. Occasional 6-inch thick layers of gray fine sand were observed between El. -35 to El. -60. Towards the bottom of the layer, 1-inch to 6-inch thick seams of silt, clayey fine sand, and gravelly low plasticity clay were encountered.

SILTY SAND - Below the clay layer, a stratum of dense to very dense silty sand and sand with silt was encountered. The thickness of this layer is not known, but it was penetrated for about 10 feet in GEI-3, for about 15 feet in boring GEI-4 and for about 50 feet in GEI-6. In GEI-6 at about El. -125, occasional seams of very stiff clay were encountered.

Water levels observed in the GEI borings at completion of drilling ranged from about El. 7 at the west and center of the site to about El. 1 at the east end of the site. These elevations are consistent with previous readings in the GZA wells, at about E. 6 in December 1992. The groundwater level is likely to vary at other times due to seasonal effects, precipitation, and the presence of underground utilities and drainage systems.

11.3 CONSTRUCTION

Temporary excavation support will be required around the complete perimeter of the site. The excavation system will be designed by a professional engineer registered in Massachusetts.

To construct the basement with its finished floor at El. 7, it will be necessary to excavate a subgrade to about El. 4 to El. 1 depending on the foundation type. This will result in an excavation that will be about 25 feet to 33 feet below street grade at the west end of the site, adjacent to the St. Mary's Street bridge. Along Babbitt Street, the excavation will be about 10 to 25 feet below grade. Along east of the site along 110-112 Cummington Street, the bottom of the excavation will be about 10 to 13 feet below existing grade. On the south side, i.e., adjacent to the Massachusetts Turnpike, the bottom of the excavation will be about 10 feet below existing Turnpike pavement elevation. Excavation will involve approximately 6,000 - 10,000 cubic yards depending on the foundation system (see Section 11.4 below).

The excavation support will consist of soldier piles and lagging or sheet-piles, toed sufficiently into the sand and gravel and clay to provide base stability. Lateral support will be provided by temporary tiebacks grouted in soil or by internal diagonal braces and rakers along the west, north and east sides of the site. Cantilever support is likely to be adequate along the south side. The space between the excavation support system and the building walls can be backfilled with compacted structural fill if there is sufficient room for access. Since the compaction will occur in a confined space, plate compactors will be required.

Vibration associated with pile driving or other construction activities will not adversely impact adjacent structures or utilities. All necessary measures will be taken to protect adjacent utilities and structures throughout demolition and construction. (Vibration mitigation is further discussed in Chapter 10.0, Noise and Vibration).

We anticipate 2 rows of tiebacks or rakers along St. Mary's Street and the west end of the site along Babbitt Street with one level elsewhere. Tiebacks will extend below utilities in Babbitt and St. Mary's streets, and beneath the near edge of buildings on the opposite side of St. Mary's Street and Babbitt Street, and below the 110-112 Cummington Street building. It is anticipated that with proper procedures and field control, the tiebacks can be installed without significant loss of ground or settlement beneath the utilities and structures. The tiebacks would be de-tensioned but left in place at the completion of construction.

Construction dewatering of the excavation will be required at the west end of the site, where the ground water will be temporarily lowered about six feet. The quantity of dewatering flow is estimated to be about 10 to 20 gpm on average, with temporary flows up to 50 gpm at the beginning of dewatering. On the east side of the excavation, the groundwater is at or below the expected bottom of the excavation, so no dewatering is anticipated at this end of the site. The localized temporary dewatering at the west end of the excavation is not expected to have any impact on the surrounding buildings and structures, and, when the dewatering is stopped, the ground water will return to its original elevation quickly.

It is anticipated that the groundwater level will be maintained at least two feet below subgrade at all times during construction to maintain a dry stable subgrade and prevent subgrade disturbance or loss of soil through the excavation support system due to inflow of groundwater. Based on the measured groundwater level of about El. 7, trenches and sumps with suitable pumping equipment extending a few feet below the excavation subgrade should be sufficient. Water will also enter the excavation from precipitation. Care will be taken to drain surface runoff away from the excavation. Dewatering activities will be conducted in accordance wit applicable MWRA and/or BWSC permits.

11.4 FACILITIES WITHIN OR NEAR THE SITE

Based on anticipated excavation levels, none of the facilities adjacent to the site are likely to be significantly impacted. Maximum lateral movements of the excavation support system are estimated to be up to 2 inches on the St. Mary's Street and Babbitt Street sides of the site, about 1 inch on the east side and about 2 to 3 inches on the Turnpike side.

Settlements of the MWRA sewer in St. Mary's Street, with its invert about 2 to 5 feet below the bottom of the excavation, is expected to be less than 0.25 inch. The foundation for the St. Mary's Street bridge is presumed to be a gravity type granite block abutment bearing on the sand layer . The elevation of the bridge foundation is expected to be about 3 to 5 feet above the bottom of the excavation. Settlement of the bridge is expected to be less than 0.5 inch, which is not expected to result in adverse impact on the bridge. No impact is expected on the buildings across both St. Mary's Street and Babbitt Street.

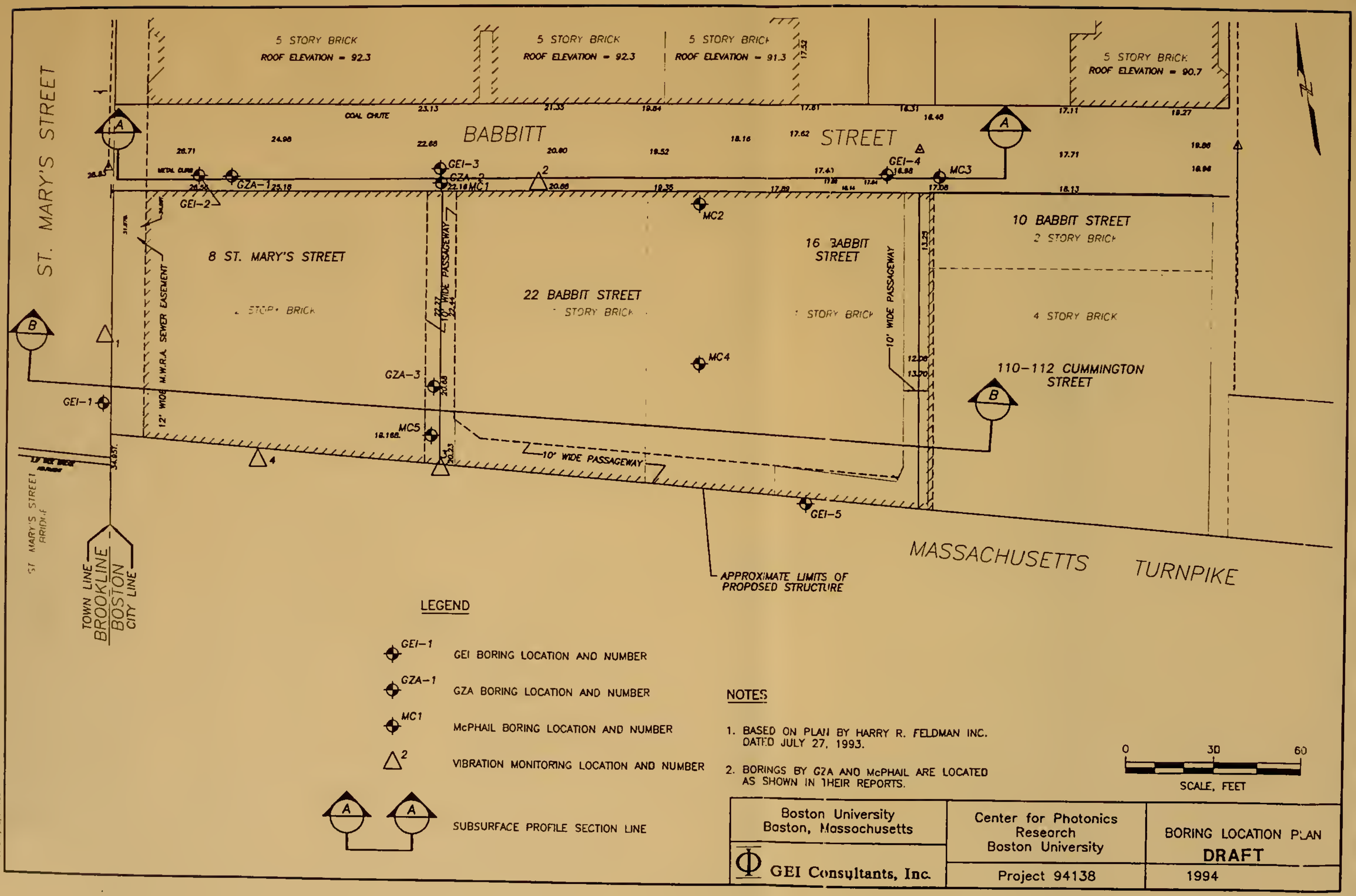
Preliminary analyses indicate consideration of both a mat and pile foundation system for the Research Center. Further analysis is underway to define the best alternative for the Project.

The bottom of the excavation will be about 3 to 5 feet below the granite block foundations of 110-112 Cummington Street. Excavation is expected to cause about 1 inch of settlement of 110-112 Cummington Street. About 2-inches of additional settlement may occur at the 110-112 Cummington Street building due to consolidation in the clay layer under the added weight of the new structure if a mat foundation is used but such settlement would not likely cause any structural damage. Such settlement would not occur if a pile foundation is used.

On the south side of the site, the bottom of the excavation will be about 10 feet below and about 20 feet away from the nearest edge of the Turnpike pavement. No significant impact on the Turnpike is expected.

11.5 CONCLUSION

Based on the results of the subsurface investigation it is expected that the proposed construction will have little or no impact on the surrounding utilities and structures. Temporary lowering the ground water up to six feet during construction is also not expected to cause any significant impacts. The ground water is expected to rapidly return to preconstruction levels, after dewatering is stopped. All necessary measures will be taken to protect adjacent structures and utilities during and after construction.



LEGEND

GEI-1 GEI BORING LOCATION AND NUMBER

GZA-1 GZA BORING LOCATION AND NUMBER

MC1 McPHAIL BORING LOCATION AND NUMBER

2 VIBRATION MONITORING LOCATION AND NUMBER

A A SUBSURFACE PROFILE SECTION LINE

NOTES

1. BASED ON PLAN BY HARRY R. FELDMAN INC. DATED JULY 27, 1993.
2. BORINGS BY GZA AND McPHAIL ARE LOCATED AS SHOWN IN THEIR REPORTS.

Boston University Boston, Massachusetts	Center for Photonics Research Boston University	BORING LOCATION PLAN DRAFT
GEI Consultants, Inc.	Project 94138	1994

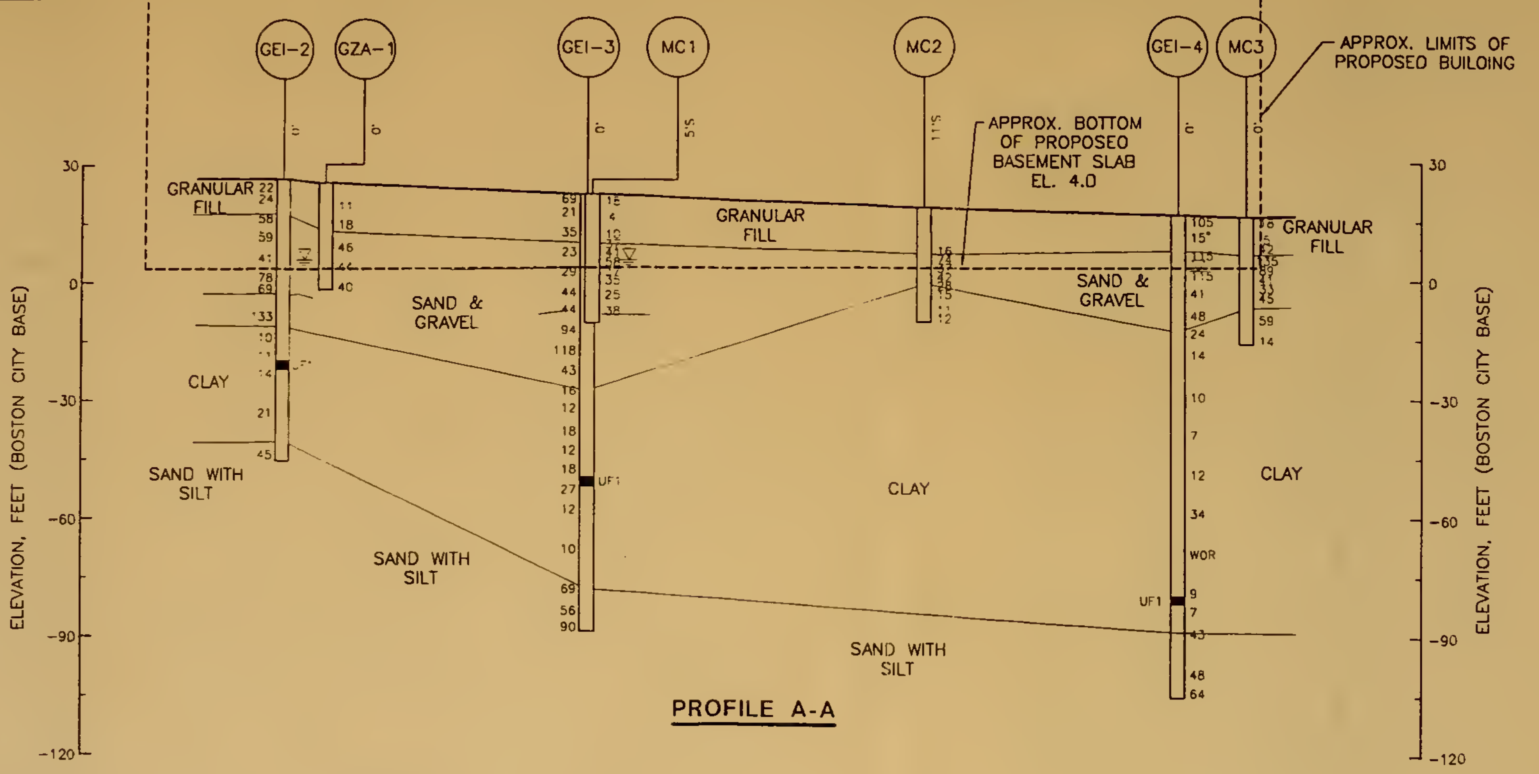
BOSTON UNIVERSITY

Center for Photonics Research

Boring Location Plan

Figure 11-1

Prepared By:
GEI Consultants Inc.
August 1994



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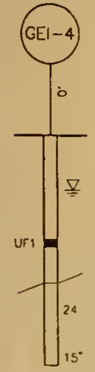


BORING NUMBER

OFFSET OF BORING FROM SECTION LINE

EXISTING GROUND SURFACE
PLANE OF CROSS-SECTION

GROUND WATER LEVEL MEASURED
AT COMPLETION OF DRILLING

UNDISTURBED FIXED PISTON SAMPLE
LOCATION AND NUMBER

STRATUM BOUNDARY

N-VALUE FROM STANDARD PENETRATION
TEST, BLOWS PER FOOT

NUMBER OF BLOWS USING 3" OD SAMPLER
AND 300lb HAMMER WITH A 24" DROP

GENERAL
NOTES

1. LOCATIONS OF PROFILES AND BORINGS ARE SHOWN IN FIGURE 2.
2. GROUND WATER LEVELS MAY VARY AT OTHER LOCATIONS AND AT OTHER TIMES OF THE YEAR. LEVELS MEASURED AT THE COMPLETION OF DRILLING MAY NOT REFLECT THE STABILIZED GROUND WATER LEVEL.
3. THE ELEVATIONS OF THE BOUNDARIES BETWEEN SOIL LAYERS MAY BE TRANSITIONAL IN NATURE AND THE LAYER BOUNDARIES BETWEEN BORINGS MAY VARY SIGNIFICANTLY FROM THE SIMPLIFIED INTERPOLATIONS SHOWN IN THE PROFILE.
4. SEE TEXT AND BORING LOGS FOR ADDITIONAL STRATA DESCRIPTIONS.

0 30 60
SCALE, FEET

Boston University Boston, Massachusetts	Center for Photonics Research Boston University	PROFILE A-A **DRAFT**
GEI Consultants, Inc.	Project 94138	1994

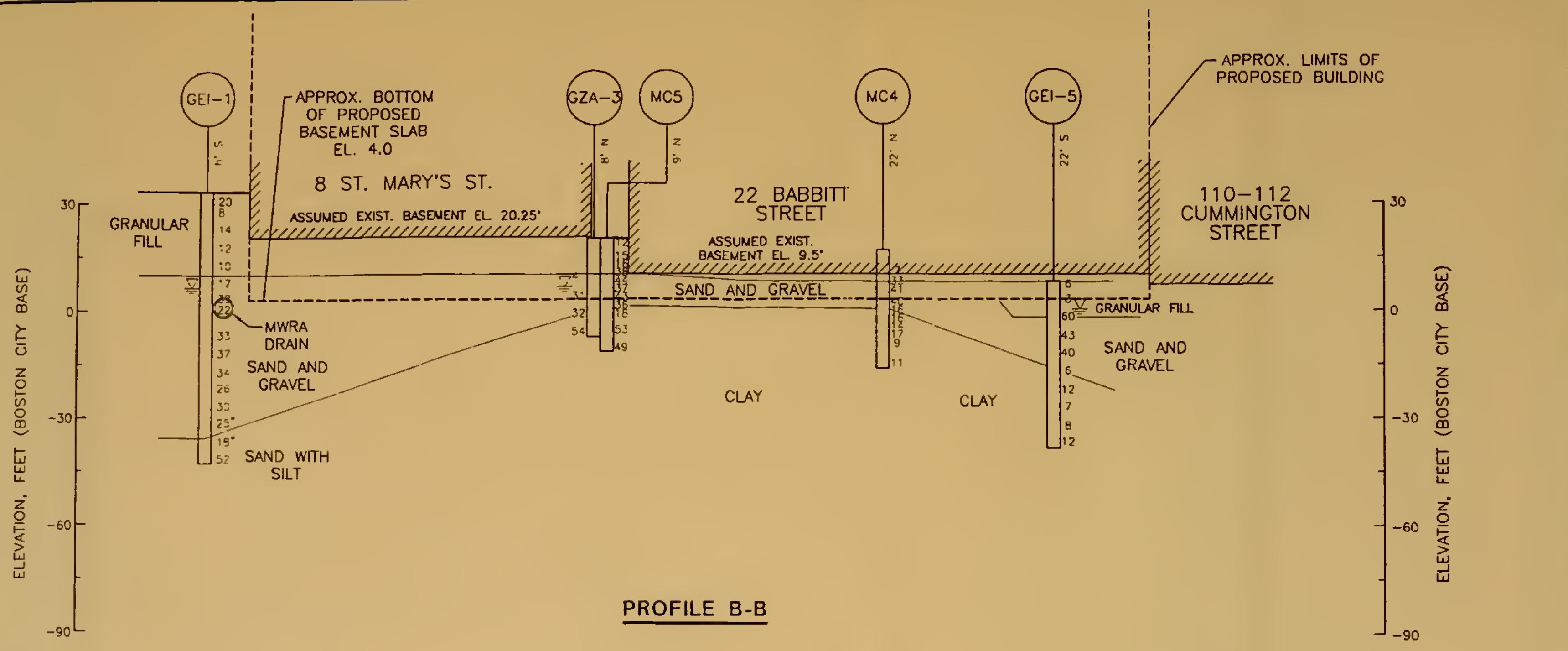
BOSTON UNIVERSITY

Center for Photonics Research

Profile A-A

Figure 11-2

Prepared By:
GEI Consultants Inc.
August 1994


GEI–1
GZA–3
MC5
MC4
GEI–5
APPROX. BOTTOM OF PROPOSED BASEMENT SLAB EL. 4.0
APPROX. LIMITS OF PROPOSED BUILDING
8 ST. MARY'S ST.
ASSUMED EXIST. BASEMENT EL. 20.25'
22 BABBITT STREET
ASSUMED EXIST. BASEMENT EL. 9.5'
110–112 CUMMINGTON STREET
GRANULAR FILL
MWRA DRAIN
SAND AND GRAVEL
SAND WITH SILT
CLAY
CLAY
SAND AND GRAVEL
GRANULAR FILL
SAND AND GRAVEL
ELEVATION, FEET (BOSTON CITY BASE)
30
0
-30
-60
-90
ELEVATION, FEET (BOSTON CITY BASE)

PROFILE B-B

LEGEND

BORING NUMBER

OFFSET OF BORING FROM SECTION LINE

EXISTING GROUND SURFACE
PLANE OF CROSS-SECTION

GROUND WATER LEVEL MEASURED
AT COMPLETION OF DRILLING

STRATUM BOUNDARY

N-VALUE FROM STANDARD PENETRATION
TEST. BLOWS PER FOOT

NUMBER OF BLOWS USING 3" OD SAMPLER
AND 300lb HAMMER WITH A 24" DROP

GENERAL
NOTES

1. LOCATIONS OF PROFILES AND BORINGS ARE SHOWN IN FIGURE 2.
2. GROUND WATER LEVELS MAY VARY AT OTHER LOCATIONS AND AT OTHER TIMES OF THE YEAR. LEVELS MEASURED AT THE COMPLETION OF DRILLING MAY NOT REFLECT THE STABILIZED GROUND WATER LEVEL.
3. THE ELEVATIONS OF THE BOUNDARIES BETWEEN SOIL LAYERS MAY BE TRANSITIONAL IN NATURE AND THE LAYER BOUNDARIES BETWEEN BORINGS MAY VARY SIGNIFICANTLY FROM THE SIMPLIFIED INTERPOLATIONS SHOWN IN THE PROFILE.
4. SEE TEXT AND BORING LOGS FOR ADDITIONAL STRATA DESCRIPTIONS

SCALE, FEET

Boston University Boston, Massachusetts	Center for Photonics Research Boston University	PROFILE B-B DRAFT
GEI Consultants, Inc.	Project 94138	1994

941381'4 7/12/94 AJS

BOSTON UNIVERSITY

Center for Photonics Research

Profile B-B

Figure 11-3

Prepared By:
GEI Consultants Inc.
August 1994

12.0 TRANSPORTATION

12.0 TRANSPORTATION

12.1 INTRODUCTION

This chapter discusses the potential transportation impacts of the Center for Photonics Research project. A discussion of existing conditions, transportation facilities and traffic in the project area is included. An analysis of the expected trip generation associated with the new research facility was performed, and traffic impacts of the Research Center were examined. Mitigation measures addressing transportation and construction traffic management are discussed as they relate to the Project and the campus.

The Project site covers a little over one acre including buildings at 8 St. Mary's Street, 12-22 Babbitt Street, 110-112 Cummington Street, and a small open space at the corner of Cummington Street. The buildings at 110-112 Cummington Street will be maintained and connected to the new Research Center building. The uses and activities associated with the 110-112 Cummington Street buildings will not change significantly as a result of the Project and will not change existing traffic patterns. Therefore, the transportation analysis does not address transportation associated with 110-112 Cummington Street.

Based on the planned program for the Project and data collected on travel origins and modes to the Boston University Charles River Campus, transportation impacts associated with the proposed Center for Photonics Research will be minimal. This is because the classroom and a substantial amount of the research facilities will primarily serve existing science and engineering activities and not result in increased enrollment at the University. Also, the new research facilities are not people-intensive and will largely employ existing graduate students. The majority of trips to and from the site will be made by existing students, faculty and employees. A small portion of trips to the site will be made by new research personnel and faculty members expected to occupy the building.

The Research Center will generate some net new trips over the existing buildings which currently occupy the Project site. However, it is important to note that the majority of trips generated by the Project will largely involve a change in walking patterns, not a change in vehicle patterns. Most of the students and faculty that will use the new Research Center are already using science and engineering facilities on campus in the science complex which is within one to two blocks of the Project site. These students and faculty already walk, ride transit, or drive to the campus, and will continue to access the campus in the same way.

12.2 STUDY AREA

The study area encompasses the Project site, direct access routes to the site, and major transportation corridors serving the site. The Project site is located on the south side of Babbitt

Street which can be accessed from both Cummington and St. Mary's Streets. Babbitt Street is a small private way which receives little through-traffic and is largely used for servicing existing buildings on site and abutting buildings. Cummington Street is a small one-way street which principally serves the campus science and engineering complex. St. Mary's Street is one-way southbound from Commonwealth Avenue and along the Project site. It converts to a two-way street farther south across the Massachusetts Turnpike. St. Mary's Street crosses over the Massachusetts Turnpike but does not provide direct Turnpike access. Commonwealth Avenue is the major east/west urban arterial street near the Project site and runs the length of the Boston University Charles River Campus. Figure 12-1 shows the Project site and study area.

12.3 STUDY METHODOLOGY

Traffic impacts of the proposed building were estimated using standard transportation planning methods. The ITE Trip Generation Manual 5th Edition does not include data on land uses comparable to the proposed Research Center. There is little data on academic facilities, and the data on research and development centers is based on independent research facilities. These data are not applicable to the Center for Photonics Research project, which is an integral part of the University's graduate and undergraduate science and engineering program. Thus, trip generation, distribution, and traffic impact estimates were based on existing data from the University regarding student, faculty and staff characteristics discussed below.

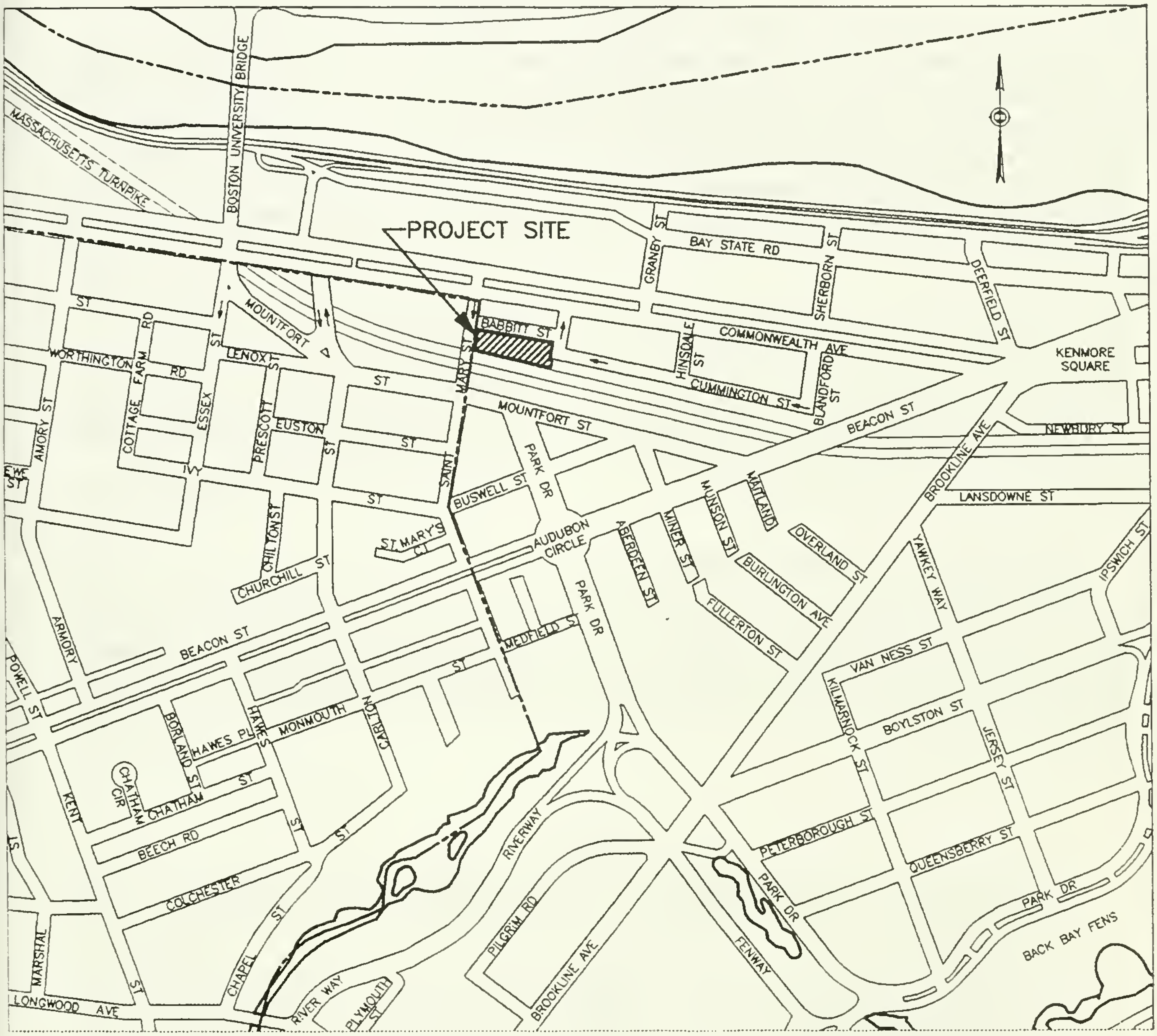
12.3.1 TRIP GENERATION METHOD AND ASSUMPTIONS

New trips generated by the Project were divided into two major categories: Employees (faculty/research leaders, staff, administrative personnel, graduate students) and undergraduate students.

Employees

The employee category includes faculty members, administrative and other staff, and graduate students. Graduate students are typically hired to conduct much of the University's research activities and exhibit similar travel patterns as faculty and employees. Although they tend to have more flexible schedules and can travel off-peak more often than other employees, they have been included in the employee category to present the worst case scenario for peak hour analysis.

All employees were assumed to arrive at the Research Center during the A.M. peak hour and leave during the P.M. peak hour. To calculate daily trips, a factor of 1.5 was applied to peak hour trips to account for additional trips made to and from the Research Center throughout the day. The daily trip factor applied to graduate student trips is 2.0, to reflect that graduate students are likely to make more trips to and from the Project than other employees.



Project Study Area

Prepared By:
Howard Stein Hudson

Figure 12-1

Undergraduate Students

For undergraduate students, trip generation was based on classroom capacity and expected occupancy rates and utilization. On average, it was assumed that six classes per day will be held in each classroom, and the classrooms will be 75% full reflecting typical enrollment patterns. This translates to total potential daily trips of 900% of classroom capacity. However, students will likely have more than one class in the new facility, so the actual number of trips external to the building will be considerably lower. Accordingly, it was assumed that 50% of the total potential daily trips are made to the new building. This results in a trip factor of 4.5 for undergraduate students.

To be conservative, it was assumed that a class begins in every classroom during the A.M. peak hour, and therefore the total potential trips would be 75% of total classroom capacity for peak hour trips. All A.M. peak hour trips are directed **to** the Research Center. In the P.M. peak hour there is the possibility that classes end and begin in every room, which translates to total potential trips of 150% of the classroom capacity. One half of the P.M. peak hour trips are **to** the Research Center, and one-half are **from** the Research Center. Assumptions on building occupancy and mode split are provided in Appendix D.

12.3.2 MODE SPLIT AND TRIP DISTRIBUTION

Mode splits for University faculty, staff and students were obtained from two sources: the 1986 Boston University Campus Parking Plan and the Boston University School of Management Final Project Impact Report (June, 1993). Mode splits were applied for the following four categories: Faculty, staff, graduate students and undergraduate students. Mode splits by University position are shown in Table 12-1.

TABLE 12-1
Modal Split by University Position

Position	Mode Split		
	Vehicle*	Transit**	Other***
Faculty/Research	80%	10%	10%
Administrative/Staff	73%	15%	12%
Graduate Students	73%	27%	
Undergraduate Students	23%	77%	

* Vehicle includes drive alone, carpool, and drop-off
** Transit includes MBTA bus and subway
*** Other includes walking and bicycling

As described in the Boston University Campus Parking Plan, trip origins for faculty and staff were collected as part of a faculty/staff questionnaire survey conducted in December, 1985. The survey also included data on travel modes. Data for faculty and staff that use vehicles to access the campus were aggregated to produce vehicle trip distributions.

Vehicle trip distributions were based on routes by which these employees travel to work. The following assumptions about trip routes were used: trips beginning east of the University access campus via Commonwealth Avenue; trips originating west of Boston travel to campus via the Massachusetts Turnpike, Memorial Drive, and the Boston University Bridge; trips originating from north travel to the University campus via Storrow Drive and Commonwealth Avenue; and trips originating south of Boston were assumed to access the campus via Route 1/Jamaicaway. These access routes by corridor are shown in Figure 12-2. Trip distribution by approach corridor is discussed below in Section 12.5.

12.4 EXISTING CONDITIONS

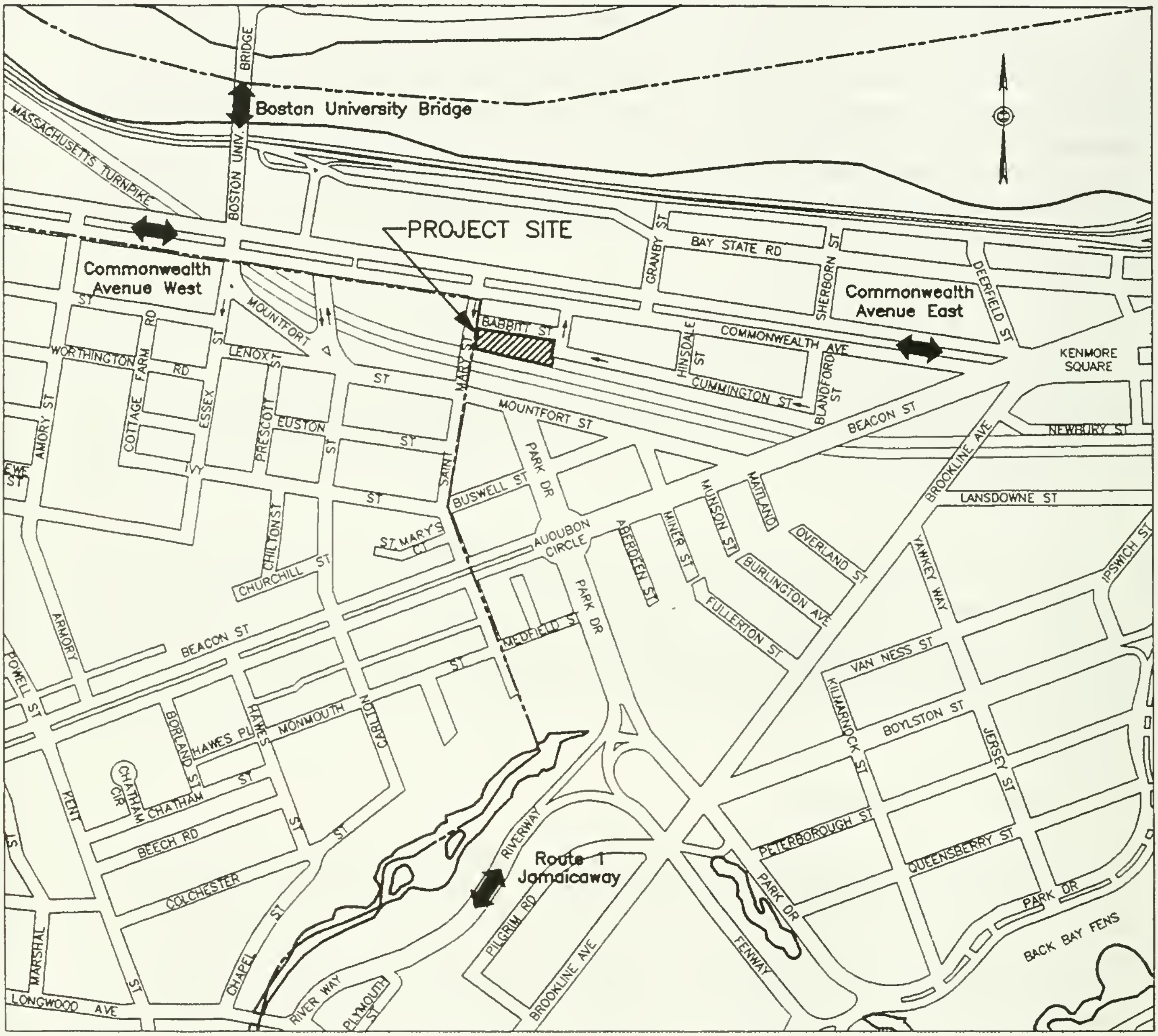
The following section describes existing conditions on the Project site and in the Project area.

Existing Site Uses

The Project site currently contains four buildings -- one vacant building and three buildings that are used by the University for academic purposes. Three of the buildings will be demolished and replaced with the new Center for Photonics Research building. Two of these buildings contain classroom and teaching laboratories with capacity for approximately 425 students. In addition, there are 30 employees currently working in the two buildings. The third building to be demolished is currently vacant. The fourth building, 110-112 Cummington Street, will remain unchanged.

Project Area Traffic Volumes

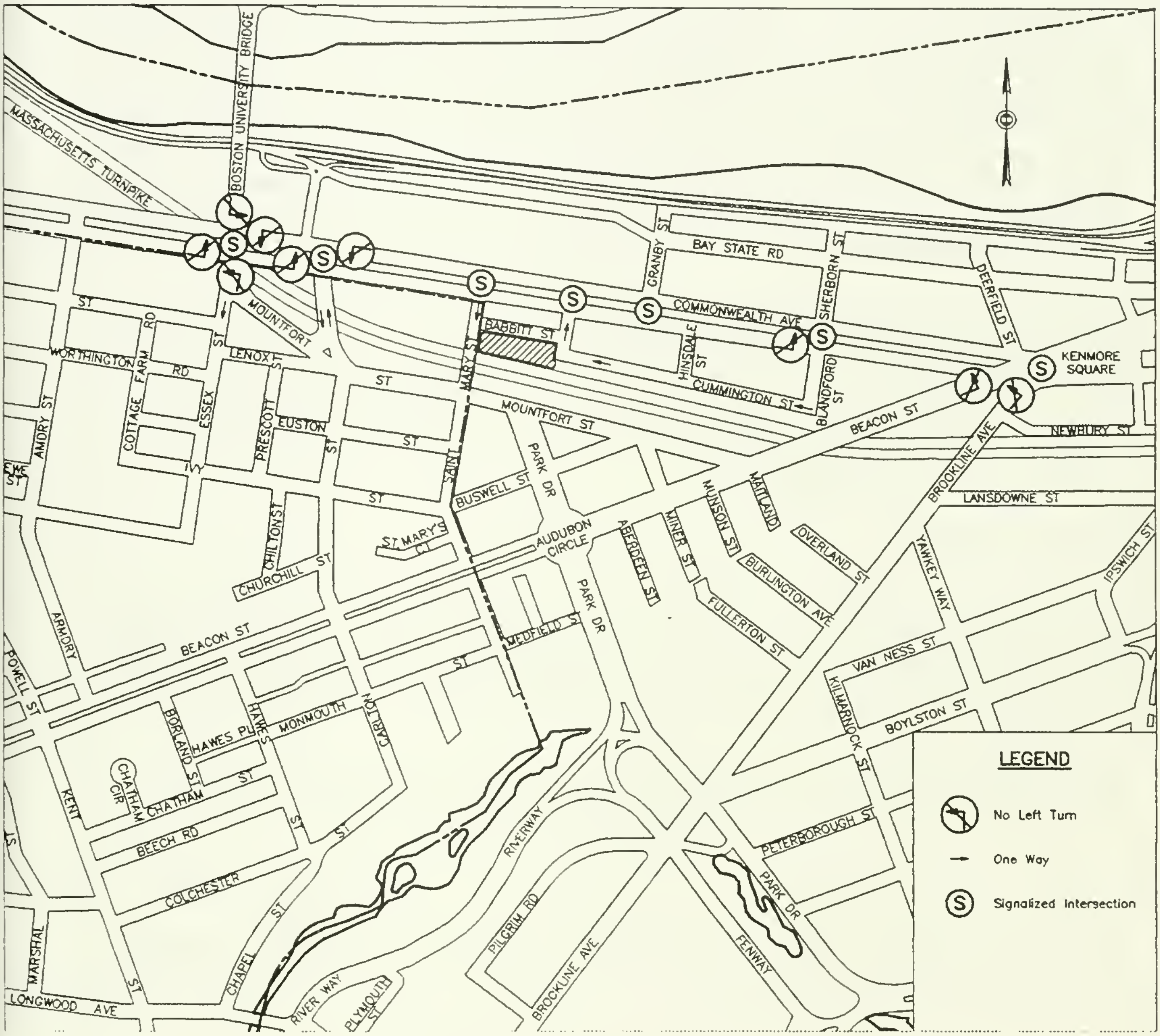
For the Boston University School of Management Environmental Impact and Project Impact Reports, measurements of traffic levels were taken along Commonwealth Avenue near Sherborn Street on May 4, 1992. The counts indicated 15,500 eastbound vehicles per day and 16,900 westbound vehicles per day for a total of 32,400 vehicles per day in both directions. Other traffic counts showed that Commonwealth Avenue carried 44,350 daily vehicles west of the Boston University Bridge and 30,400 vehicles east of University Road in 1987. The traffic count for St. Mary's Street, a southbound one way street from Commonwealth Avenue over the Turnpike was 1,248 vehicles (Boston Transportation Department, 1981 counts from 7 A.M. to 6 P.M.). Figure 12-3 illustrates road and circulation characteristics near the Project site.



Transportation Study Area

Prepared By:
Howard Stein Hudson

Figure 12-2



Existing Roadway Circulation and Traffic Controls

Prepared By:
Howard Stein Hudson

Figure 12-3

Public Transportation Facilities

Commonwealth Avenue is the major local automobile route on campus. It also provides inbound and outbound Massachusetts Bay Transportation Authority (MBTA) trolley service along the main campus and serves major bus routes. It is located within easy walking distance, one block north of the Project site. The MBTA Green Line ("B" Branch) is located in the median between the east and westbound traffic lanes. There are two MBTA stops located on this line which are in close proximity to the Project site. One stop, B.U. East, is located at the Cummington Street intersection. The other stop, B.U. Central, is located at the St. Mary's Street intersection. Both stops are approximately one block from the Project site.

In addition to the MBTA Green Line, two MBTA bus routes, #47 and #57, serve the Project. Bus route #47 operates between Central Square in Cambridge and Boston City Hospital in the South End. It crosses the Boston University Bridge and serves the western portion of the campus. Bus route #57 provides service between Watertown Square and Kenmore Square, traveling via Brighton Avenue and Commonwealth Avenue. Figure 12-4 illustrates public transportation serving the Project area.

Other Transportation

In addition to services offered by the MBTA, Boston University operates two shuttle bus routes when classes are in session. One route operates as an internal circulation service for the Charles River Campus, providing service between 1266 Commonwealth Avenue and Kenmore Square. The other route connects the Charles River Campus with the Boston University Medical school and University Hospital located in the South End.

The University provides bicycle parking throughout campus at key locations, including the Cummington Street open space on the Project site.

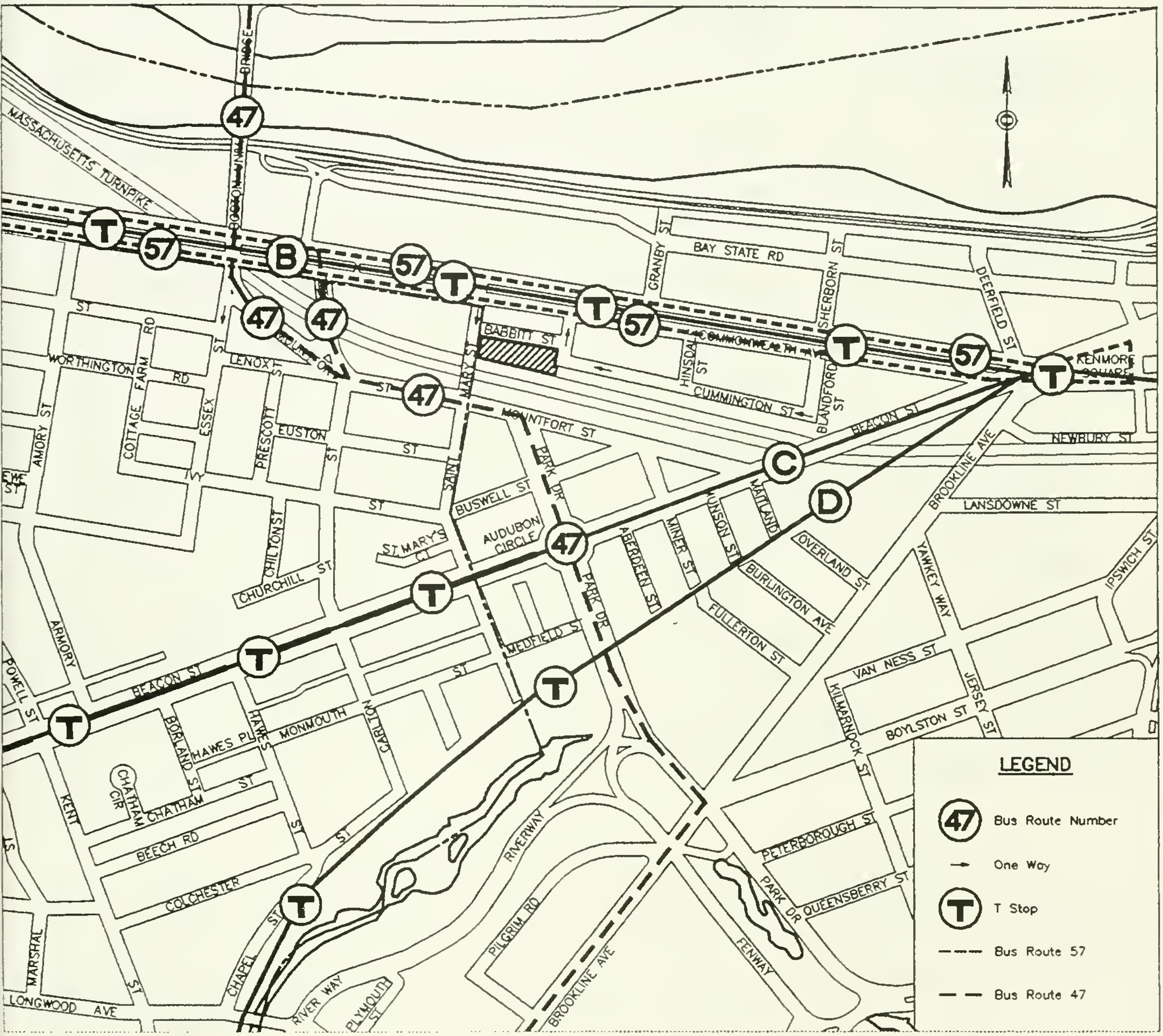
Parking

The following provides a summary of previous and current parking characteristics on campus.

1986 Charles River Campus Parking Study

Boston University commissioned a comprehensive parking study of its Charles River Campus in 1985-1986 (Boston University Campus Parking Plan, Technical Report, Vanasse Hangen Brustlin, Inc., June 1986). This parking study included a detailed inventory of available parking spaces campus-wide, an assessment of campus parking requirements, strategies to improve the parking system, and other recommendations. The major findings of the report were as follows:

- The total on-campus parking supply consisted of 2,473 spaces. More than 2,000 of these spaces were located in thirteen off-street facilities distributed throughout the campus. The remaining off-street spaces were located behind and adjacent to campus buildings.



Location of Public Transportation

Prepared By:
Howard Stein Hudson

Figure 12-4

- On a typical weekday, parking demand at the University peaks at approximately 11:00 A.M.. Parking demand at this hour was estimated to total 2,905 spaces, exceeding the available supply at University-controlled facilities (2,473 spaces) by 432 vehicles.

- The total supply of off-street spaces (2,473 spaces) when added to the curbside parking supply used by the University community (270 spaces throughout the campus) provided an overall total supply of 2,743 spaces. Adjusting to account for inefficiencies resulting from turnover activities, the estimated capacity of the University parking system was reduced to 2,572 spaces, including the on-street public spaces. Relative to this adjusted capacity, the estimated peak period parking deficit was 333 spaces (2,905 space demand minus 2,572 space-adjusted supply). Demand exceeded adjusted capacity by 200 or more spaces from 9:00 A.M. through 4:00 P.M. on a typical weekday.

- The area west of the Boston University Bridge had a surplus of parking spaces, even during peak periods. On the Central Campus, however, it remained difficult to locate vacant parking spaces between 9:00 A.M. and 4:00 P.M..

Current Charles River Campus Parking Supply

The current parking supply managed by the University's Office of Parking Services contains approximately of 3,076 spaces campus-wide. This represents an increase of 603 new spaces over the 1986 supply. This supply will increase by an additional 89 spaces when the Boston School of Management project (595 Commonwealth Avenue) is completed in 1996. Major changes to the parking supply since the 1986 study include:

- 547 spaces added at 899-925 Commonwealth Avenue on the site of the former Commonwealth Armory (relocation of the National Guard).

- 56 spaces added in the Electrocom Area (Babcock Annex) on Babcock Street.

- 56 spaces were added to the 125 spaces at 595 Commonwealth Avenue. The new School of Management under construction will create an additional 89 spaces creating a total of 270 spaces at that location.

- Approximately 300 spaces of the parking supply added to the public supply of off-street parking at 730 - 766 Commonwealth Avenue.

- 88 spaces eliminated at 602 Commonwealth Ave. as a result of the construction of the Physics and Biological Sciences Building, formerly the Morse Auditorium parking area.

- 56 spaces eliminated from two lots on Cummington Street.

- 18 spaces eliminated at 635 Commonwealth Avenue.

The University acquired commercially operated lots located at 10 Deerfield Street, containing 116 spaces, and 730 Commonwealth Avenue, containing 38 spaces. While these spaces were new to the University system, they are not new to the parking supply in the area.

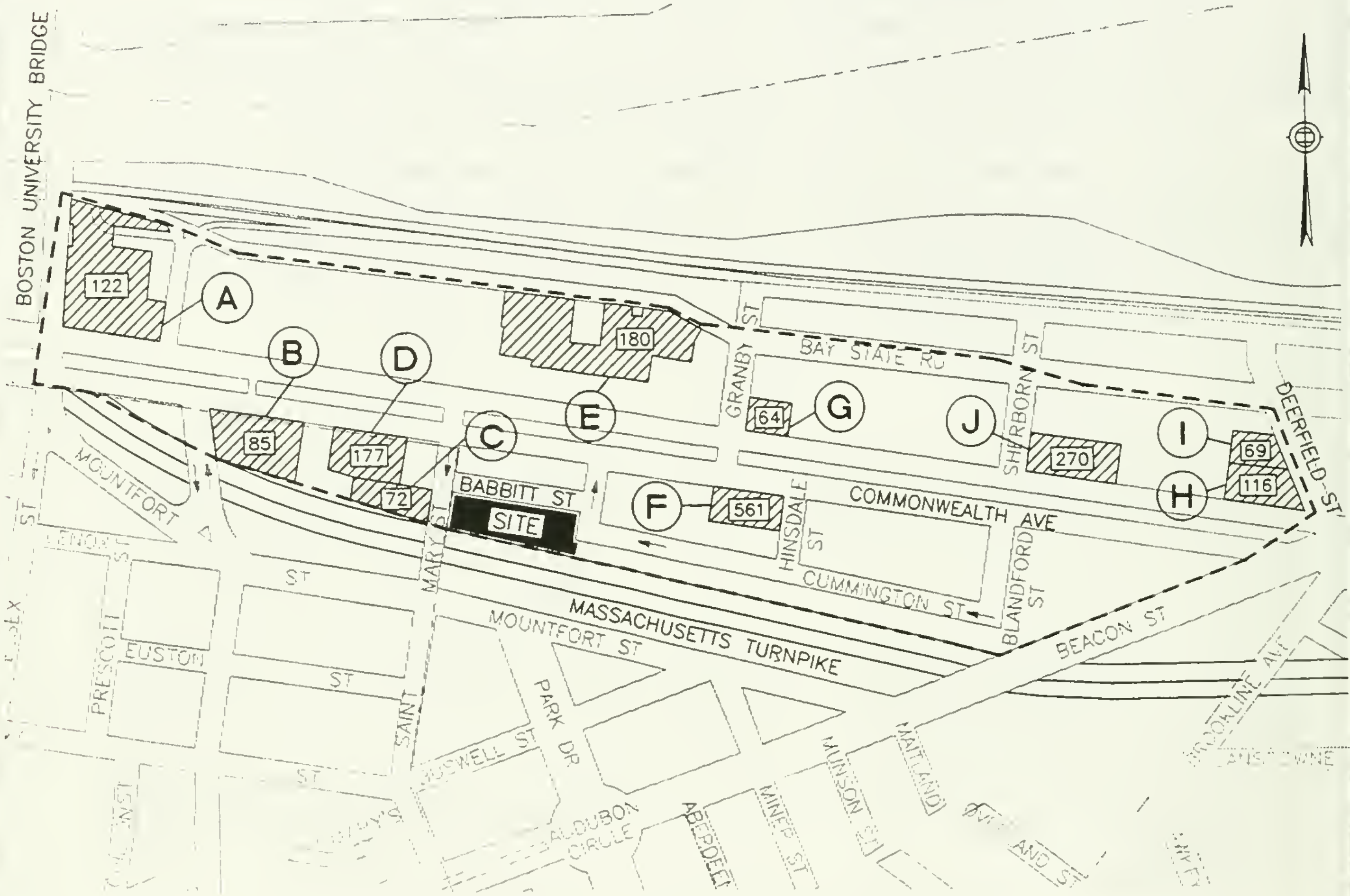
The parking demands of the campus remain similar to 1986. There is high demand on the central part of campus. Employee lots experience very little turnover during the day. Commercial lots offer some capacity varying throughout the day and the academic year. The west part of campus continues to provide surplus parking particularly at 899-925 Commonwealth Avenue (former Commonwealth Armory site).

Project Area Parking Supply

There are a number of University owned and commercial parking facilities near the Project site. Between the Massachusetts Turnpike and Bay State Road, from the Boston University Bridge up to Kenmore Square, there are approximately 1,446 off-street parking spaces (see Table 1). The new School of Management project, currently under construction, has created temporary loss of 181 off-street spaces. When the School of Management is completed, there will be a total of 270 spaces on the site for a net increase of 89. In addition to off-street parking, there are two and four hour on-street meters throughout the area along Commonwealth Avenue, St. Mary's Street, Cummington Street, and other side streets within the Project parking area.

Figure 12-5 shows the location of off-street parking facilities controlled by the University. Spaces in alleys and driveways are not shown. Table 12-2 below summarizes the parking supply in the Project area.

Parking needs for the Project will be accommodated as part of the overall Boston University parking management for the campus. According to the University Office of Parking Services, it is contemplated that University-controlled commercial parking at 730 - 766 Commonwealth Avenue will be reallocated for employee parking to meet University needs during and after construction of the Project.



Project Area Parking Locations

Prepared By: Howard Stein Hudson	***Figure 12-5***

TABLE 12-2
Project Area Off-Street Parking Supply

Location	Lot	No. of Spaces
795 Commonwealth Ave.	A	122
766 Commonwealth Ave.	B	85
740 Commonwealth Ave.	C	72
730 Commonwealth Ave.	D	177
725 Commonwealth Ave.	E	180
700 Commonwealth Ave.	F	561
665 Commonwealth Ave.	G	64
10 Deerfield St.	H	116
30 Deerfield St.	I	69
SUBTOTAL		1,446
595 Commonwealth Ave.*	J	270
TOTAL		1,716

*595 Commonwealth Avenue is currently under construction but is estimated to be open by the time the Project is completed.

12.5 PROJECT IMPACTS

The following section presents the planned building program for the Center for Photonics Research, expected trip generation (person and vehicle) and the resulting probable traffic impacts of the Project.

12.5.1 CENTER FOR PHOTONICS RESEARCH BUILDING PROGRAM

The new Center for Photonics Research building will contain classroom capacity for approximately 878 students, including small classrooms and a 200 seat lecture hall. Actual classroom capacity will depend on seating arrangements, but classrooms are designed to accommodate a maximum of 878 seats.

Research laboratory and office space (non-Photonics related) will support approximately 208 people, including faculty, graduate students and administrative/support staff. Photonics related laboratory and office space will have a capacity of approximately 245 persons, also including faculty/research leaders, graduate students and support staff. In addition, there will be a 200 seat seminar room on the ninth floor. Table 12-3 shows the capacity and function of each floor of the Research Center.

TABLE 12-3
Estimated Occupancy and Use of Photonics Research Center Building

Floor	**Capacity**	**Function**
Basement	30	Photonics -- laboratory, mechanical
First Floor	386	Engineering -- classrooms, laboratory, office, loading, entrance
Second Floor	534	Engineering -- classrooms, lecture hall, entrance
Third Floor	55	Engineering -- laboratory, office
Fourth Floor	56	Engineering -- laboratory, office
Fifth Floor	56	Engineering -- laboratory, office
Sixth Floor	56	Photonics -- laboratory, office
Seventh Floor	54	Photonics -- laboratory, office
Eighth Floor	54	Photonics -- laboratory, office
Ninth Floor	250	Photonics -- laboratory, office, seminar room
TOTALS	1,531	208 -- Engineering -- laboratory, office 245 -- Photonics -- laboratory, office 878 -- Engineering -- classroom and lecture hall 200 -- Photonics -- seminar room

Capacities were calculated based on usable (net assignable) square footage on each floor and average square footage required per person for research and non-research activities. An average space value of 300 net assignable square feet was assigned to each person for research activities on floors containing laboratory and office space. The ninth floor contains mostly administrative space. The occupancy reflects the number of offices and administrative support space plus the 200 seat seminar room capacity.

As discussed in the introduction, much of the new Research Center will be filled by existing University faculty, staff and students. Estimates of persons to be relocated to the new facility from other locations on campus reflect estimates provided by Boston University Office of Space Management. Table 12-4 shows a summary of the capacity of the building, and the number of personnel expected to be relocated to the building from current campus locations.

TABLE 12-4
Summary of Research Center Building Capacity and Use

Position	Total Capacity			Relocated*	New to Campus
	Photonics	Engineering	Combined		
Faculty/Research	49	42	91	23	68
Administrative/Staff	25	21	46	20	26
Graduate Students**	171	145	316	316	0
Total Employees	245	208	453	359	94
Undergraduate Students	0	878	878	878	0
TOTAL	245	1,086	1,331***	1,237	94

* Includes 30 employees in existing buildings on site to be demolished.
** Existing graduate students will be relocated to the new building.
*** Excludes 200 seat seminar room planned for building occupants use.

As shown in Table 12-4, less than 100 people that will use the new Research Center are expected to be new to the campus. Students and graduate students using the new building will be existing University students. Laboratories are typically occupied by research teams of five. The five members include four students (graduate and post doctorate) and one faculty or research leader. The students in these research teams are recruited from existing University enrollment and do not constitute new students on campus or in the science and engineering complex. The only new people associated with the Research Center laboratories who generate new trips will be the research leaders who are not relocated from existing academic facilities. The vacated space resulting from the Project is largely laboratory space within the science and engineering complex. It is estimated that up to ten new faculty could be accommodated in the vacated space. In addition, five new administration positions could be accommodated in this vacated Bay State Road offices (see Chapter 3.0, Zoning and Master Plan Consistency). No new students would result from programming in the vacated space. New employment associated with the vacated space would result in insignificant traffic impacts, particularly in light of the transportation mode split discussed below in Section 12.5.3. In conclusion, new people on campus resulting from the Project reflect new faculty and/or research leaders and support staff. Students taking classes or assisting in research in the building are not included. Therefore, new people represent a relatively small group.

The relocation of existing University faculty, employees, and students to the Project site will have little or no impact on the Project area. The majority of personnel and students using the building are already located in existing science and engineering facilities within two blocks of the Project site.

The seminar room, located on the ninth floor of the new building, will be largely used for luncheons, professional briefings, and special lectures for the Research Center occupants. It is not anticipated that the room will be used on a daily basis.

12.5.2 TRIP GENERATION

Table 12-5 shows the total anticipated person trips to and from the new Research Center building, and associated **new** trips to and from the campus. As shown in the Table, the majority of the total trips that will be made to the Research Center are already made to the campus, and within the campus largely to the same area as the Project.

As discussed previously in Section 12.3, Methodology, trips generated by the new building were divided into employee trips and undergraduate student trips. For the purposes of analysis, it is assumed that all occupants of the building travel during A.M. and P.M. peak hours. The resulting number of trip ends made by faculty and staff to and from the Research Center, using a 1.5 trip factor, is 411. The daily trip factor applied to the graduate student trips was 2.0 since graduate students make more trips than other employees. The resulting trip generation for graduate students using the Research Center is estimated to be 1,264 trips to and from the building.

In determining peak hour trips, it was assumed as a worst case that a class begins in every classroom during the A.M. peak hour, and therefore the total potential trips is 75% of the 878 student classroom capacity. Assuming all A.M. peak hour trips are traveling to the site, there will be 659 trips to the site at this time. It is assumed that one half of the P.M. peak hour trips are made to the Research Center and one half are from the Research Center. This is due to the worst case possibility that in the P.M. peak hour classes begin and end in every classroom, which translates to total potential trips of 150% of the classroom capacity resulting in 1,317 trips to and from the Research Center during P.M. peak hour. A factor of 4.5 is applied to classroom capacity reflecting expected 75% occupancy and turnover of six classes per room throughout the day for a total of 3,951 undergraduate student trips in and out of the building.

TABLE 12-5
Total and New Trip Ends Generated by the Center for Photonics Research

Position	Total Trip Ends to/from Center			New Trip Ends to/from Campus		
	A.M. Peak Hour	P.M. Peak Hour	Total Daily	A.M. Peak Hour	P.M. Peak Hour	Total Daily
Faculty/Research	91	91	273	68	68	204
Administrative/Staff	46	46	138	26	26	78
Graduate Students	316	316	1264	0	0	0
Undergraduate Students	659	1317	3951	0	0	0
TOTAL	1112	1770	5626	94	94	282

The majority of trips associated with the Research Center building are not new to campus. Table 12-5 shows the number of new trip ends to campus resulting from the Project as compared to trips associated with the new building. The campus will be impacted only by the trips associated with new activities and employment associated with the Project, resulting in 282 net new trip ends to and from campus.

12.5.3 NEW TRIP MODE SPLIT

Of greatest concern are the vehicle trips, which will generate additional traffic and parking demand. As discussed above in Section 12.3, between 73% and 80% of faculty and staff access the campus by vehicle, either driving alone, carpooling, or being dropped off. Ten to fifteen percent use transit (trolley or bus) and the remaining ten to twelve percent access the campus by other modes (walking, bicycle, etc.). Table 12-6 shows the mode split applied to anticipated new trips to campus.

TABLE 12-6
New Trips to and from Campus by Mode

Mode	A.M. Peak Hour	P.M. Peak Hour	Total Daily
Vehicle	73	73	220
Transit*	11	11	32
Other**	10	10	30
TOTAL	94	94	282

* Transit includes MBTA trolley and bus.
** Other includes walking, bicycling

12.5.4 VEHICLE TRIP DISTRIBUTION

Vehicle trip distribution was estimated using data collected in a survey given (December, 1985) to faculty and staff as part of the Boston University School of Management Final Project Impact Report. The survey included data on trip origin, travel mode, and trip end. Data for faculty and staff that use vehicles to access the campus were aggregated to produce vehicle trip distributions. The trip origins identified by zip code were used to assume routes by which these employees travel to work. The assumptions described in the study methodology section led to the estimation that 34% of the trips to campus gain access via Commonwealth Avenue east of the project site, 28% via Commonwealth Avenue west of the project site, 26% via the Boston University Bridge, and 12% via Route 1/Jamaicaway. Figure 12-6 shows the distribution of trips to and from the Center for Photonics Research.

The distributional splits were applied to the new vehicle trips to and from campus, 220 total daily, 73 each peak hour, to estimate the number of new vehicle trips on each route to campus. To be conservative, it is assumed all drivers will commute at peak hour. Table 12-7 shows the total new vehicle trips to and from campus by route.

Additional traffic volumes associated with the Project on Commonwealth Avenue reflect less than one half of 1% of the total daily volumes on Commonwealth Avenue east of the Boston University Bridge.

TABLE 12-7
Distribution of Total New Vehicle Trips to Campus *

Route to/from Research Center	%	Number of Trips		
		A.M. Peak Hour	P.M. Peak Hour	Total Daily
BU Bridge	26%	19	19	57
Commonwealth Ave, east of site	34%	25	25	74
Commonwealth Ave, west of site	28%	21	21	63
Route 1/Jamaicaway	12%	8	8	26
TOTAL	100%	73	73	220

* Numbers and percents may not add up due to rounding.
Detailed calculations relating to trip generation and trip distribution are included in Appendix D.

12.6 SITE CIRCULATION

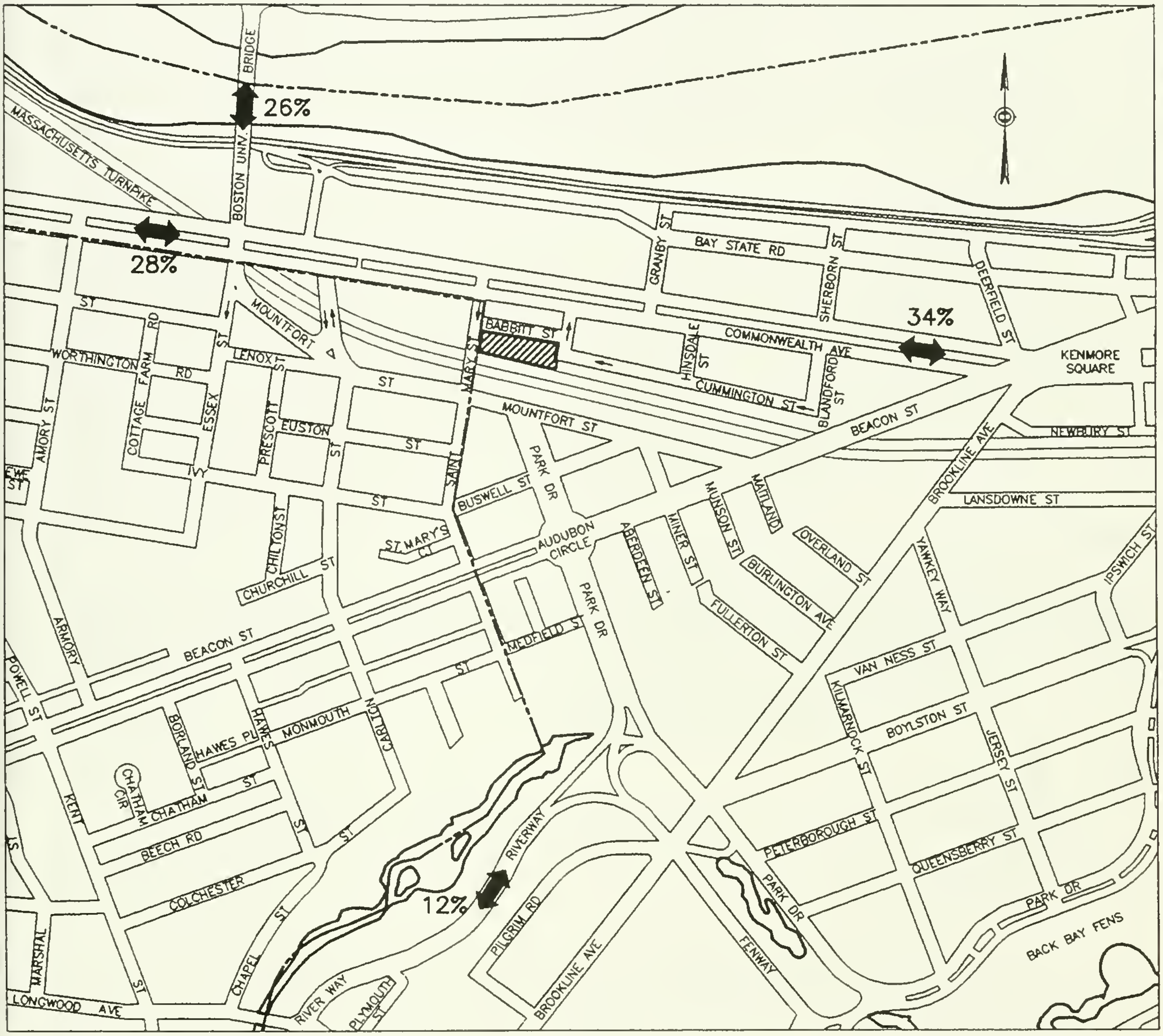
A detailed project description is provided in Chapter 2.0, Project Description, including further discussion of site access and circulation. Figure 12-7 illustrates truck servicing, pedestrian, and drop-off access on the Project site.

Trucks and Service Vehicles

Facilities for truck delivery and building servicing at the Research Center include one loading bay for deliveries, and one bay for a trash dumpster, located along Babbitt Street east of the main entrance. Materials and supplies used at existing University research facilities are generally received at a central location on the University campus, and then distributed within the University by small vans. This procedure will be followed for most of the supplies and materials used at the Center for Photonics Research. Low truck and service vehicle volumes are expected. Deliveries and servicing of the Project will be managed as part of campus-wide servicing activities.

Pedestrian

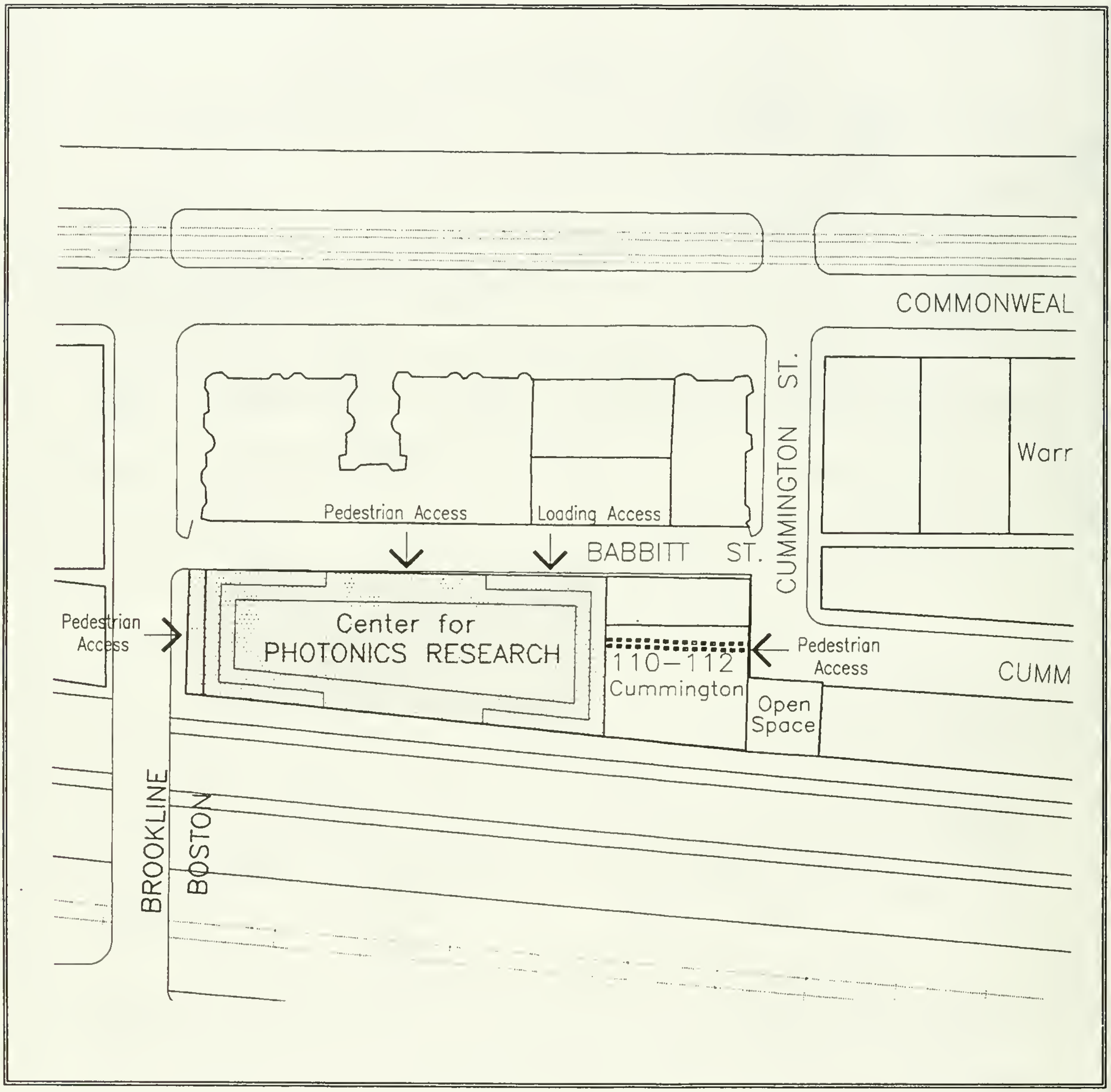
The new Research Center building will provide two major pedestrian entries into the building. One entry will be located on the first floor along Babbitt Street and the other located at the second floor level along St. Mary's Street. Site access will also be provided from 110-112 Cummington Street. A connection between 110-112 Cummington Street and the new Research Center will be created allowing fuller internal circulation.



Vehicle Trip Distribution

Prepared By:
Howard Stein Hudson

Figure 12-6



Site Access and Circulation

Prepared By:
Cannon

Figure 12-7

Parking

Currently, the Project site contains no parking facilities, nor will any be constructed as part of the Project. Parking needs for the Center for Photonics Research project will be managed as part of the Boston University supply for the campus. It is anticipated that existing personnel driving to campus will continue their travel and parking pattern to campus even if they are relocated to the Project site. New parking demand for the Research Center is estimated to be approximately 73 spaces corresponding to the number of new vehicle trips associated with the Project as described above.

Although these people are expected to make some vehicle trips during the day, it is assumed that these trips would only be off-campus since there are excellent walking, bicycling, and alternative transit modes available to achieve on-campus trips. Therefore, those additional trips would not create additional parking demand on campus and it is anticipated that no more than 73 parking spaces would be in demand at any given time. These new spaces are expected to be assigned or available at one or more of the nearby lots at 730, 740, 700, and/or 766 Commonwealth Avenue with a combined capacity of almost 900 parking spaces. With over 3,000 managed parking spaces on the Charles River Campus, the projected additional demand of 73 spaces can easily be accommodated. Figure 12-5 illustrates parking facilities in the study area.

12.7 BROOKLINE

The Town of Brookline has requested information about the magnitude of additional trips and parking demand generated by the Research Center on nearby Brookline neighborhoods.

Particular concern was expressed regarding the following three intersections:

- St. Mary's Street/Mountfort Street.
- Carlton Street/Mountfort Street/Lenox Street.
- Carlton Street/Commonwealth Avenue.

New Brookline Vehicle Trips

As shown in Table 12-7, additional traffic generated by the Project will be low, 220 new total daily trips, distributed among various corridors. Trips accessing the site from the west, traveling on Commonwealth Avenue through Brookline, constitute approximately 28% of the daily new vehicle trips to campus. This is equivalent to approximately 21 vehicles in each peak hour. Only 12% of new vehicle trips will access the Project site via Route 1/Jamaicaway, with the possibility of travel through Brookline. This will amount to only 8 vehicles in each peak hour. Together, Brookline will experience 29 new peak hour vehicle trips from these corridors and only 98 total new daily vehicle trips. This increase in vehicle trips will not adversely impact the intersections of concern.

The Final Environmental Impact Report for 899-925 Commonwealth Avenue (the

Commonwealth Armory) includes level of service analyses for two of the identified intersections for the A.M. and P.M. peak hours. These analyses using 1990 traffic volumes show that the signalized intersections at Carlton Street/Mountfort Street/Lenox Street and Carlton Street/Commonwealth Avenue operate at a level of service B in the both A.M. and P.M. peak hours. Since the Research Center is expected to generate only a small number of new trips to the site, it is assumed that these intersections can easily accommodate any additional traffic generated by the Research Center without deteriorating the level of service.

Parking

As noted above, parking can easily be accommodated by the parking supply on campus. Most trips associated with the Center for Photonics Research are trips already being made to campus, most of which are already focused on the science and engineering complex adjacent to the Project site. New parking demand is estimated at 73. This incremental increase will be absorbed into the existing campus facilities and will not likely impact nearby Brookline neighborhoods.

Construction

Construction vehicle routes associated with the Center for Photonics Research will likely involve the use of St. Mary's Street and Commonwealth Avenue in Boston and Brookline. Equipment staging, construction schedule, truck routes and volumes have not yet been developed. The University is committed to work closely with the Town of Brookline in developing an acceptable construction management plan and appropriate mitigation measures prior to the commencement of construction.

12.8 CONSTRUCTION IMPACTS

The details of construction have not yet been developed in detail. Information available about the construction period relating to traffic and parking is summarized below. A more complete discussion of construction activities is provided in Chapter 15.0, Construction.

- The peak number of construction workers at the site is not expected to exceed approximately 100-150 workers.
- Construction worker parking is planned to be accommodated at the Armory site (899-925 Commonwealth Avenue).
- Construction hours may vary but, are expected to occur during normal work hours (7:00 A.M. - 3:30 P.M.).
- Trucks will likely access the site via Commonwealth Avenue, Hindsdale, and Blandford streets to Cummington Street.

- Street closures are expected to be minimal. Vehicular access to properties affected by construction will be maintained or alternate arrangements will be made.

- Some construction activities may require the use of the breakdown lane of the Massachusetts Turnpike. Vehicles related to this construction will have no direct impact on local streets.

As construction plans are developed, a detailed Construction Traffic Management Plan will be developed to minimize impacts on the Project area during the construction period, in accordance with City of Boston regulations.

12.9 TRANSPORTATION MITIGATION PLAN

The Center for Photonics Research project is forecast to have a negligible impact on the transportation system in the Project area. This is because the Research Center will replace existing science and engineering facilities on campus, providing new and upgraded facilities to existing graduate and undergraduate students. The Project will not result in the addition of graduate or undergraduate students to the University. The Project will create a relatively small number of new faculty, researchers, and other employees on the campus.

Although no mitigation is warranted for potential transportation impacts associated with this project, Boston University is committed to campus transportation demand management strategies which mitigate potential impacts. Many of these strategies have already been implemented as referenced in previous transportation access plan agreements with the City of Boston. These strategies outlined herein will be incorporated in a Transportation Access Plan Agreement (TAPA) between the proponent and the City of Boston.

Travel Demand Management

Reducing the number of vehicle trips to and from the campus is a key element of mitigation. Boston University implements travel demand reduction strategies which deal with the campus as a whole. When integrated into a comprehensive transportation management strategy, travel demand management can reduce automobile usage and potentially reduce physical impacts to roadways. The demand associated with the Center for Photonics Research will be incorporated into the University's travel demand management programs. As part of the upcoming 1996 Charles River Campus Master Plan, a transportation component will be included.

Ridesharing, public transportation promotion, and on-campus transit pass availability are all measures designed to reduce the number of vehicle trips to the area during the peak commuting hours and on a daily basis. Ridesharing, where commuters participate in carpools and vanpools, decreases the number of vehicles using area roadways, thereby reducing congestion, air pollution, parking requirements, and fuel consumption.

Promoting the use of public transportation as a means of traveling to the University is also an effective way to reduce vehicular traffic. The University currently sells MBTA transit passes in the George Sherman Student Union which is centrally located for students and employees. The campus is exceptionally accessible by public transportation, including the eight stops on the MBTA "B" Green line, two MBTA bus lines, and the University's own shuttle bus service.

Bicycle Transportation

In addition to promoting public transit as an alternate mode of travel to campus, the University encourages the use of bicycles. An indoor secure bicycle storage area will be provided on the first floor of the new Research Center building as a supplement to existing outside storage facilities on site. (See Chapter 2.0, Project Description)

Vehicle Access and Circulation

New vehicle trips to the University generated by the Project will not be coming directly to the site, but rather to existing University parking facilities in the area. Therefore, it is appropriate that vehicle access and circulation related to the Research Center will be dealt with at the campus-wide level rather than the site specific level. The University police and other personnel directly enforce the City's posted traffic and parking regulations in and around the Boston University campus.

Pedestrian Access and Circulation

A key element that ties many of the mitigation plan's physical elements together is the development of a comprehensive pedestrian-oriented signage program. Signs will be erected to direct pedestrians to and from public transportation services and to guide pedestrians to major locations and facilities on the campus. The University is committed to providing a circulation pattern for the development site that is barrier free, allowing free movement by individuals with physical disabilities into and throughout the Project buildings and site.

Construction Traffic Management

In addition to ensuring safe vehicular and pedestrian flow after completion of the Project, safe access and circulation must be maintained throughout the construction period. The following measures will be incorporated into the construction mitigation plan at the site:

- A Construction Traffic Management Plan will be developed which will detail the specific procedures to be followed by the University and construction contractors.

- The University will subsidize construction worker MBTA passes for the duration of the construction period to reduce traffic and parking demands.

- Designated truck routes will be established to govern how trucks access the site. Trucks will be restricted to major arteries, and prohibited from residential areas.

- Pedestrian flow and safety will be maintained throughout the construction period including covered pedestrian walkways where appropriate.

- Police officer traffic control will be provided as necessary throughout construction. The need for police officers will be determined jointly with the Boston Transportation Department and the Town of Brookline. Police officers will be responsible for maintaining safe flow of vehicles and pedestrians, and for responding to any unanticipated events.

12.10 CONCLUSION

The Center for Photonics Research will generate a small number of new trips to the site and result in few new vehicle trips to campus. The Project, therefore, will not create significant new parking demands or significant traffic impacts. Furthermore, the Project site is well served by public transportation, the University shuttle bus service and bicycle facilities throughout the campus.

The Project will not increase student enrollment and most of the personnel in the building will be comprised of existing science and engineering faculty, staff and graduate students. It is estimated that the Project will add approximately 94 new personnel to the campus. Of these new people, only a portion are expected to drive to campus resulting in an estimated 220 total new daily vehicle trips in and out of the campus and an increased demand of 73 parking spaces. The number of vehicle trips attributed to each major vehicle access corridor are too small to significantly affect A.M. or P.M. peak hour conditions.

Since the Project does not include the construction of new parking on the Project site, new trips associated with the Project will not be directed to the site but will be dispersed throughout the campus parking system. There are nearby parking facilities controlled by the University and the University has a comprehensive parking system of over 3,000 parking spaces on the Charles River Campus which can absorb the parking needs associated with the Project.

13.0 HISTORICAL/ARCHAEOLOGICAL RESOURCES

13.0 HISTORICAL/ARCHAEOLOGICAL RESOURCES

13.1 INTRODUCTION

This chapter discusses the historical and archaeological resources on and near the Boston University Center for Photonics Research site. Research was conducted at the Massachusetts Historical Commission, Boston Landmarks Commission, and the Brookline Preservation Commission to identify potential historic and archaeological resources associated with the Project site. No buildings on site are listed or eligible for listing on local, state, or National registers of historic buildings. The Project site is not within, nor does it directly abut, any listed historic districts. Research revealed no record of archaeological or pre-historic resources present on site. A map showing historic resources in the area is provided in Figure 13-1.

13.2 EXISTING CONDITIONS

The Project site is currently occupied by several buildings which vary in age and size. The building at 8 St. Mary's Street consists of a two story brick building constructed in 1917 replacing a residential structure. The building was occupied by various industrial and office businesses including the Wagner Electric Corp. from 1932 - 1837, H.G. Davis Automobile Air and Spring Service from 1937 - 1960, and the Beckwith Elevator and Lift Co. from 1960 - 1978. Prior to being vacated, the building was occupied by Metropolitan Parking Services Inc. in 1960.

The 12-22 Babbitt Street building is owned and occupied by Boston University as part of the science and engineering complex. The 18-22 Babbitt Street building was built by the University in 1984 for academic use. Prior to 1984, the site was occupied by a structure which housed an automotive repair garage from 1914 to 1954 approximately and appears to have been the location of a sheet metal works facility in 1964. By 1982, the site was a vacant lot used for parking and the location of a communications dish-type antenna. Today it is a one story building with a basement. The 12 Babbitt Street building, also a one story building with a basement, was built in 1925 and renovated in 1984 when the neighboring 18-22 Babbitt Street building was constructed.

The 110-112 Cummington Street building was built in the 1850's and expanded near the turn of the century. In 1962, the University purchased the building and renovated it for academic uses.

13.3 POTENTIAL IMPACTS

Historical resources in the general area of the Project site will not be significantly impacted by the Project. Figure 13-1 shows the location of historic resources in the area.

The closest historic district in Boston near the Project site is the Back Bay West/Bay State Road Architectural Conservation District. The western tip of the district is located to the northeast of the Project site approximately 800 feet from the Project site. The Project is not close enough to create an impact on this district. Even during the winter study scenarios, shadows will not reach the district (see Chapter 5.0, Shadow).

The Charles River Basin District encompasses the Charles River and associated recreational areas along the riverbank. This district is located farther north of the Project site than the Bay State Road/Back Bay West district and will not be impacted by the Project.

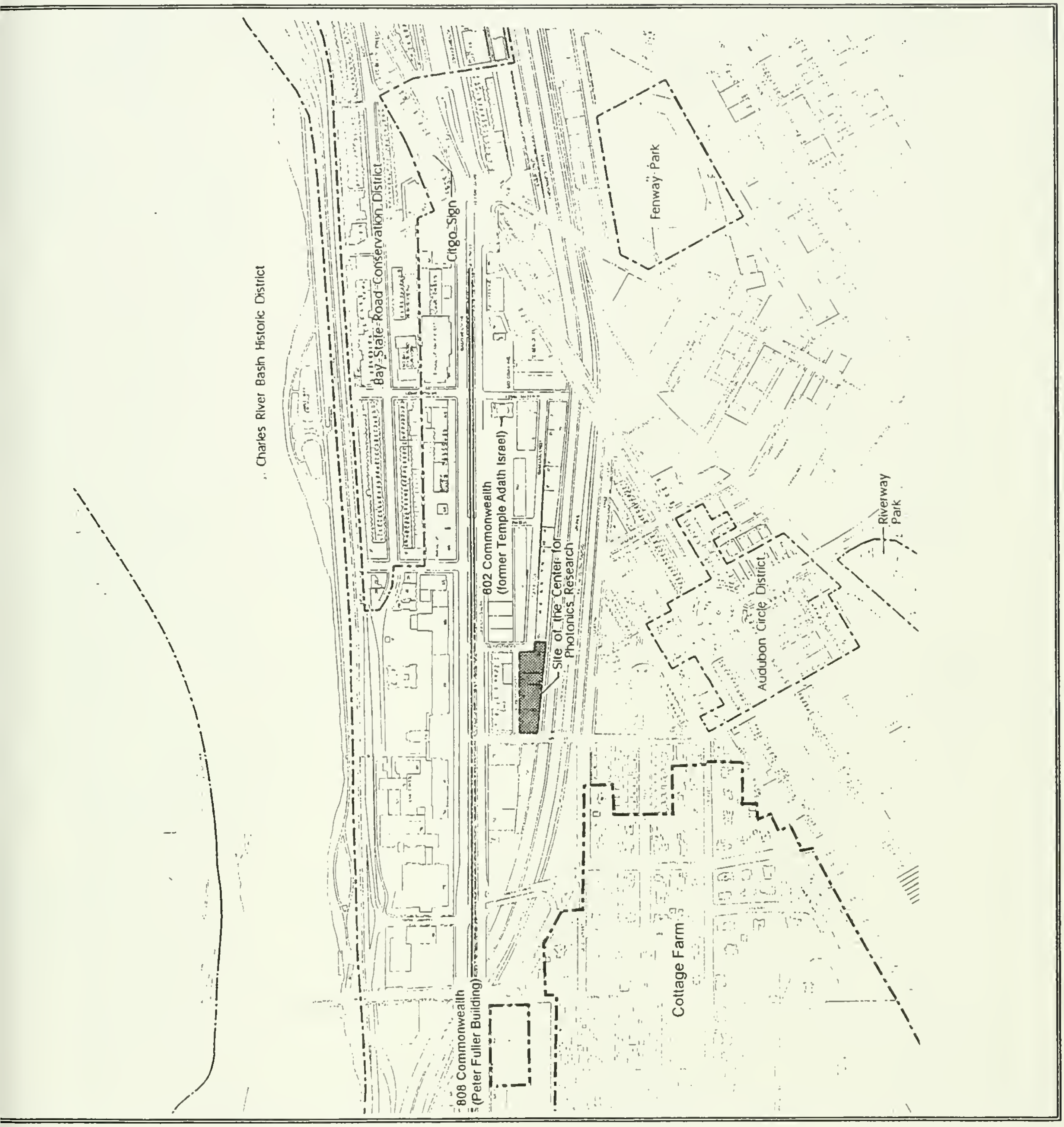
The Cottage Farm Historic District is located southwest of the Project site across the Massachusetts Turnpike in Brookline. This district is listed on local, state and federal registers. Although the new Research Center may be seen from locations within the district, the Project will not significantly impact this district.

The Audubon Circle area is located approximately 700 feet south of the Project site across the Massachusetts Turnpike. This area has been surveyed for inclusion as an architectural conservation district but has not been listed as eligible by the Boston Landmarks Commission. Although the Project will be visible from locations within the neighborhood, this area will not be significantly impacted by the Project.

Other historic resources in the vicinity of the Project are the Peter Fuller Cadillac building (808 Commonwealth Avenue), and Fenway Park.

13.4 CONCLUSION

The Project is not located in or adjacent to historic districts or resources. Also, there are no records of pre-historic archaeological resources on site. The Project will not create adverse impacts on historic or archaeological resources.


Charles River Basin Historic District
Bay State Road Conservation District
Citgo Sign
Fenway Park
802 Commonwealth (former Temple Adath Israel)
Site of the Center for Photonics Research
Riverway Park
Audubon Circle District
Cottage Farm
808 Commonwealth (Peter Fuller Building)

Historic Resources

Prepared By:
Cannon/Fort Point Associates

Figure 13-1

14.0 INFRASTRUCTURE

14.0 INFRASTRUCTURE

14.1 INTRODUCTION

This chapter presents information about the network of utility infrastructure available for the new Center for Photonics Research building. It also evaluates the existing capacities of and project impacts on the existing systems; and examines measures to mitigate any possible adverse impacts on these systems. The systems given consideration in this section include: water system, sanitary sewer, storm drains, electric, gas and telecommunications.

The analysis of utility infrastructure is based on the review of information, record plans, and test results on systems in the project area and on consultation with personnel from the Boston Water and Sewer Commission (BWSC), Massachusetts Water Resources Authority (MWRA), the Town of Brookline, Boston Edison Company, Boston Gas Company, and NYNEX. Supporting calculations, test results and records of project related correspondence are included in Appendix E, Infrastructure. Meetings and correspondence with affected parties and agencies will continue as the Project design advances.

All water and sewer connections will be constructed in conformance with the applicable BWSC and/or MWRA requirements. The proponent will employ the best practical conservation methods in the HVAC systems, plumbing fixtures, and other systems which use water and power. An overview of the Project's utility demand by use is shown in Table 14-1.

TABLE 14-1
Utility Demand Summary

Utility Service	Agency	Service Demand	Service Size
Electrical	Boston Edison Company	4,110 Kilowatts	2, 13.8 KV Medium Voltage (2, 5 inch conduits each)*
Gas	Boston Gas Company	30,300 CFH	8-inch Steel Pipe*
Telecommunication	Boston University New England Telephone	N/A	4, 4-inch Fiber Ducts Encased in Concrete*
Water	Boston Water and Sewer Commission	338 GPM	6-inch Connection, DI pipe
Fire Protection	Boston Water and Sewer Commission	1,000 GPM	8-inch Connection DI pipe
Sewer	Boston Water and Sewer Commission	10,910 GPD	(2) 8-inch Connection, PVC
Storm Drainage	Boston Water and Sewer Commission	3.3 CFS (10 yr. storm)	(2) 12-inch Connection, RCP
*Services will also backfeed the 110-112 Cummington Street building.			
Source: Cannon, URS			

14.2 WATER SYSTEM

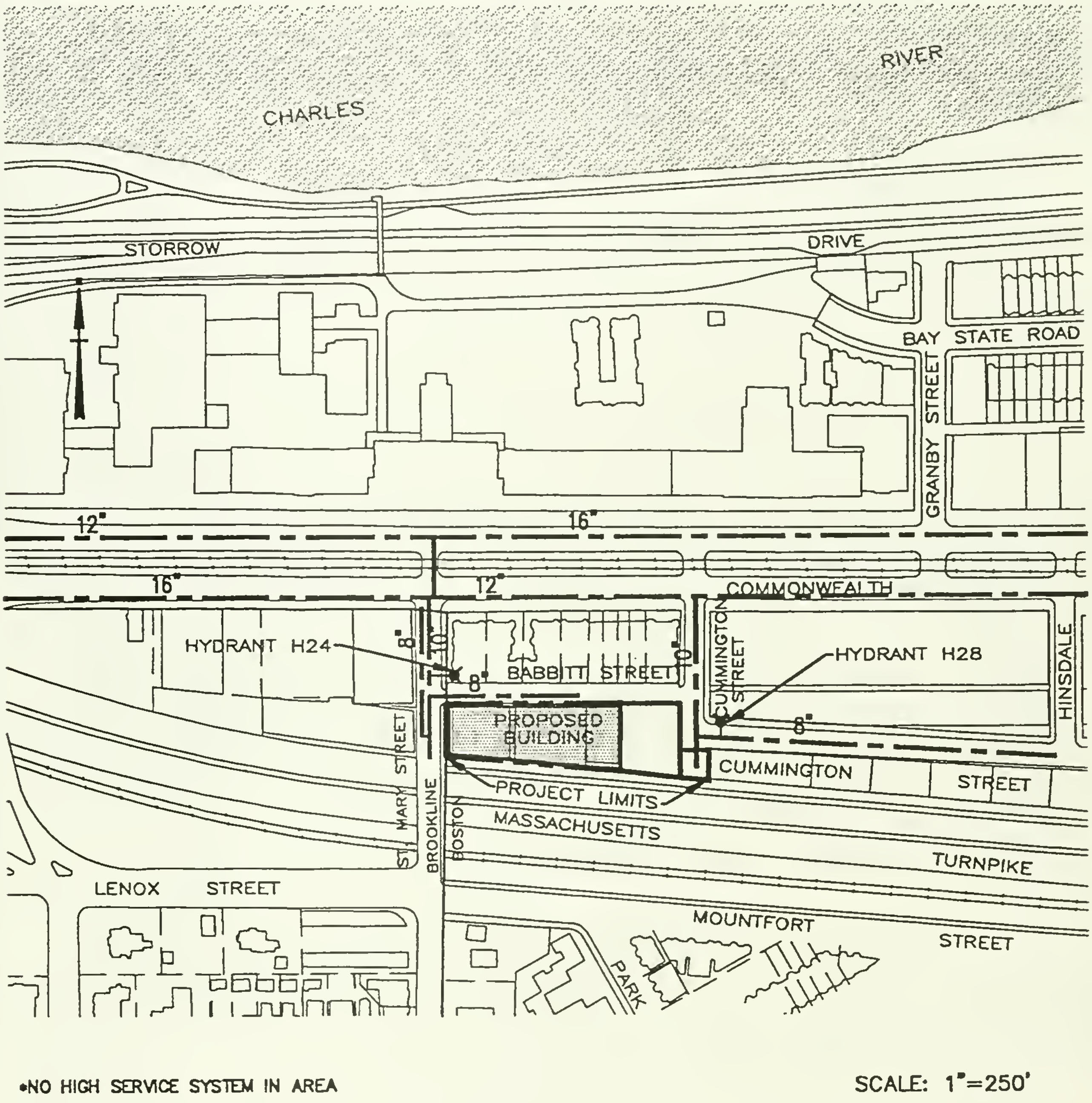
Existing Condition

The existing water supply system in the area of the project site is maintained by the BWSC. Water supply systems available to the project include an 8-inch southern low service (SL) pit cast iron main which enters from St. Mary's Street and dead ends at a point 235 feet east of St. Mary's Street on Babbitt Street as shown in Figure 14-1. The 8-inch main is fed by a 10-inch (SL) main in St. Mary's Street adjacent to the site. The 10-inch main in St. Mary's Street is fed from a 16-inch (SL) main in Commonwealth Avenue. The 10-inch main dead ends at a point 220 feet South of Commonwealth Avenue in St. Mary's Street. Hydrant H24, adjacent to the northwest corner of the project site is fed from this 10-inch SL main. The 16-inch SL main which follows along Commonwealth Avenue was installed in 1963 and cleaned and lined in 1990 by the BWSC. The 16-inch main is fed from a 48-inch SL main in Kenmore Square.

Proceeding easterly from the intersection of St. Mary's Street and Commonwealth Avenue, there is a 12-inch SL main which follows Commonwealth Avenue and feeds a 10-inch SL main. The 10-inch SL main turns South on Cummington Street and feeds an 8-inch SL main which turns easterly with the alignment of Cummington Street. Hydrant H28 adjacent to the southeast corner of the 110 Cummington Street building is fed from this 8-inch SL main. A review of BWSC water distribution maps shows that southern low service systems are providing both domestic and fire water service to the project area. There are no high service systems in the immediate area.

On August 29, 1994, the BWSC conducted Fire Flow Tests on the two hydrants adjacent to the project site. Hydrant H24 is on St. Mary's Street and hydrant H28 is on Cummington Street. A determination of the static pressure, residual pressure, and estimated flows in the existing water mains that will service the project site was made. Hydrant H24 is fed by the 10-inch southern low main in St. Mary's Street. Hydrant H28 is fed by the 8-inch southern low main in Cummington Street. The results of these tests are as follows:

	Hydrant 24	Hydrant 28
Static Pressure	60 PSI	58 PSI
Residual Pressure	39 PSI	40 PSI
Estimated Flow	1186 GPM	1143 GPM
Flow available at 20 PSI	1638 GPM	1711 GPM



Existing Low Service Water Distribution System

Commonwealth Ave. Area

Prepared By:
URS Consultants

Figure 14-1

Project Impact

The estimated total water demand for the project has been generated and includes domestic use, air conditioning make up water, and fire protection requirements. The total demand by category is as follows:

Domestic Water	240 GPM
Air Conditioning Make-Up Water	98 GPM
Fire Protection Water	1000 GPM

System Capacity

The hydrant flow test results listed above show adequate flow capacity available at 20 psi to service the projected total water demand for the project.

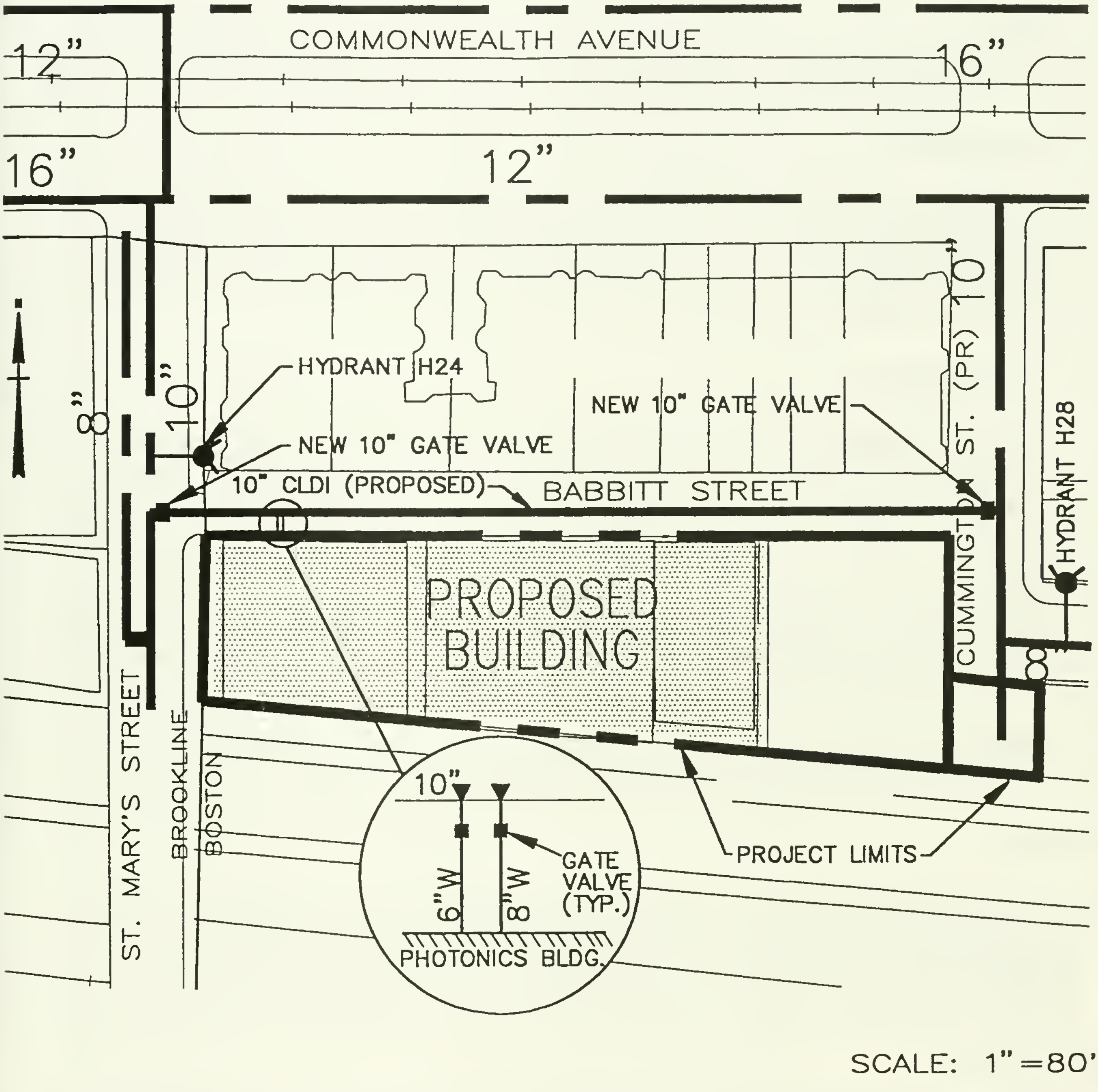
In order to reinforce the water distribution system and improve water quality for the Project area, the existing 8-inch water main on Babbitt Street should be replaced with a new 10-inch main the length of Babbitt Street to connect to the existing 10-inch mains in Cummington and St. Mary's Streets. This will complete the 10-inch main loop and further enhance flow characteristics in the Project area and will minimize public hazard or inconvenience in the event of a water main break.

The domestic water service for the project will be furnished by a 6-inch diameter cement lined ductile iron service which will be brought in from the new 10-inch main in Babbitt Street. A separate 8-inch service connection will be brought in from the 10-inch main for fire protection. Gate valves will be installed between the taps and the building, and at both ends of the new 10-inch main as shown in Figure 14-2.

14.2.1 FIRE PROTECTION SYSTEMS AND CONNECTIONS

The new building will be provided with a complete wet pipe sprinkler and standpipe system in accordance with Massachusetts State Building Code and National Fire Protection Association (NFPA) standard 13 and 14. A total of three standpipes are anticipated to provide the necessary hose coverage. Each standpipe will be Class III type suitable for supplying both 2 1/2 inch hose valves and sprinkler system at each floor level.

An 8-inch tap from the proposed 10-inch water main in Babbitt Street will serve the building fire protection system. A 1,000 gallon per minute fire pump will be provided to boost the supply water pressure for the system. The fire pump will be installed in the basement floor level and shall comply with the requirements of NFPA 20. Fire pump assembly will include jockey pump, pump controllers, test connection and Boston Fire Department approved siamese connection.



New Water Service Connections

Prepared By:
URS Consultants

Figure 14-2

14.2.2 WATER CONSERVATION

The mechanical systems will incorporate all practical water conservation measures throughout the building to assist in reducing the water usage. The benefits will be derived on a continuous basis for the expected building life. The water conservation measures are provided below.

Plumbing Fixtures

All plumbing fixtures will be low flow water conserving type. Water closets will be flush valve type using 1.6 gallons per flush. All lavatories and sinks will be provided with the 0.5 gallons per minute faucet flow aerators. There will be a limited number of showers provided, all will include the 1.5 gallons per minute regulated shower heads. Infrared type automatic sensor operated faucets will be provided in all student and public toilet spaces.

Air Conditioning

A central refrigeration plant of approximately 1,880 tons will serve the cooling requirements for the building air conditioning systems and the laboratory process chilled water system serving lasers, environmental chambers, etc. Due to the size of the refrigeration plant, utilization of air cooled chillers is not feasible. The heat rejection will be accomplished through three similar sized cross flow evaporative cooling towers. The towers shall include high efficiency drift eliminators to reduce water loss created from drift. Fans will have a two-speed operation and sequenced for minimal operation during peak load conditions. Maximum full load conditions occur for a limited number of hours annually. Water loss due to drift will be further reduced with fans operating at low speed or off with the tower in natural evaporative mode.

The limitations of the Project do not afford the option of on-site rainwater collection and retention for use as make-up water with the cooling tower system.

Boilers

The central steam plant will consist of three 350 Boiler Horsepower (BH) boilers to serve the building heating and humidification needs and the laboratory use. All steam, other than humidification use, will be converted to condensate. All condensate shall be collected and returned to the boiler feed system to reduce the raw water make-up required.

Irrigation

The urban location and site limitations of the Project do not allow for significant landscaping features. Therefore, no irrigation system or water usage will be required for the Project landscaping.

14.3 SANITARY SEWER

Existing Condition

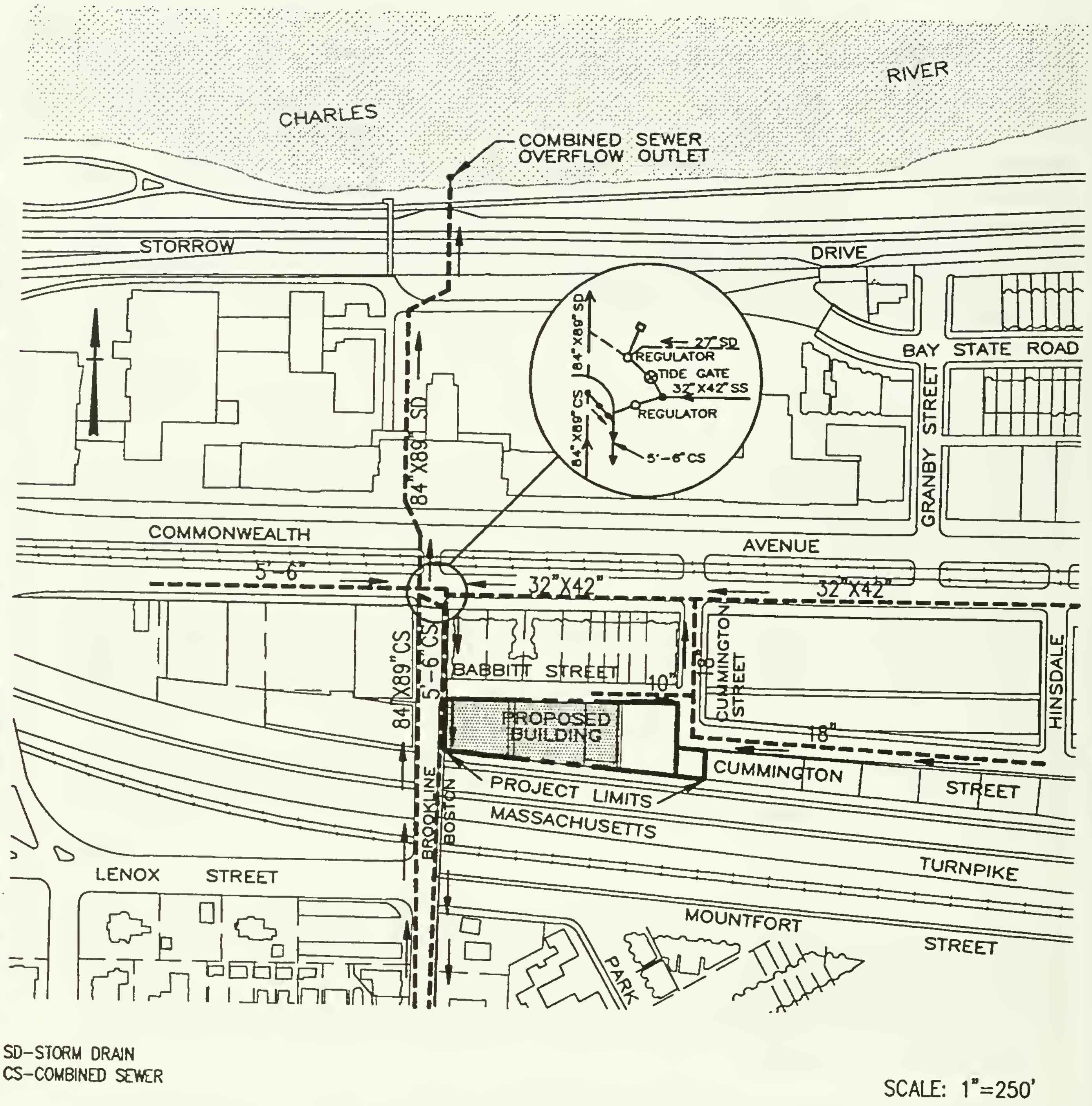
The existing sanitary sewer (SS) systems in the project area are under the jurisdiction of BWSC, MWRA and the Town of Brookline. The majority of sewers in the project area 18 inches diameter or less are constructed of vitrified clay pipe, while sewers greater than 18 inches primarily consist of brick and mortar. Sanitary service at the project site begins with a 10-inch diameter pipe in Babbitt Street at a point approximately 170 feet west of Cummington Street (see Figure 14-3). The original construction for this 10-inch sewer is shown on a Boston Public Works Plan (circa 1900, complete date illegible) which shows that the 10-inch pipe was encased in concrete with a 15-inch storm drain approximately 2 feet directly above it, also encased in concrete.

The 10-inch sewer connects to a manhole in Babbitt Street. BWSC plans indicate an invert at the manhole of 7.68 for the SS. The 10-inch sewer flows easterly to an 18-inch sewer in Cummington that flows to the north following along Cummington Street to Commonwealth Avenue. At Commonwealth Avenue the 18-inch sewer connects to a 32-inch x 42-inch sewer. The 32-inch x 42-inch sewer flows westerly along Commonwealth Avenue for approximately 1,200 feet to a manhole connection just east of the intersection of St. Mary's Street (see Figure 14-3).

Downstream of the manhole there are two branch lines. One branch consists of a 32-inch x 42-inch sewer which appears to flow to the 5 foot - 6 inch combined sewer (CS). The 5 foot - 6-inch MWRA sewer is known as the Charles River Valley Sewer (combined sewer). The 5 foot - 6-inch MWRA sewer flows east to west along Commonwealth Avenue and turns South on St. Mary's Street and continues under the Massachusetts Turnpike and on to the MWRA Deer Island Treatment Plant. At one time, the other branch line overflowed to a tidegate upstream of an 84-inch x 89-inch combined sewer. This branch line has since been disconnected and all the flow goes to the 5 foot - 6-inch MWRA sewer.

The 84-inch x 89-inch sewer runs parallel to the 5 foot - 6-inch MWRA sewer in St. Mary's Street. At the intersection at Commonwealth Avenue, the 84-inch x 89-inch line changes from a combined sewer to a storm drain. The combined sewer flow from the 84-inch x 89-inch line then flows through a series of three structures into the 5 foot 6-inch MWRA sewer and from there, flows out to the MWRA Deer Island Treatment Plant. The 84-inch x 89-inch storm drain portion continues across Commonwealth Avenue to an outfall at the Charles River.

To estimate existing waste water flows, criteria established by the Massachusetts Department of Environmental Protection (DEP) are used. 310 CMR 15.00, DEP regulation, "Title V" provides table 15.02 for estimating daily flows for a 24-hour period based on applicable use as follows: "Estimated sewage flows ... should be considered in relation to actual meter readings of established flows. Generally, estimated sewage flows will be based on 200 percent of average water meter readings in order to assimilate maximum daily flows."



Existing Sanitary Sewer Distribution System

Commonwealth Ave. Area

Prepared By:
URS Consultants

Figure 14-3

The objective of developing an estimate of the existing wastewater flow to sewer systems directly impacted by the project is to compare that estimate to the total capacity of the sewer main and thus be able to arrive at an estimate of available capacity to service the projected flows.

The steps involved in establishing current usage included: a field survey at all building addresses that could possibly have sewer connections to the 10-inch sanitary sewer in Babbitt Street; obtaining average water meter readings from BWSC for these addresses; performing an analysis to estimate maximum daily flows using the DEP criteria stated above; comparing the estimated flow to pipe capacity.

A summary of the results of the analysis by component flow to the 10-inch sewer follows:

Component Flow	Maximum Daily Flow (GPD)	Source/Method*
704 - 728 Comm. Ave	53,004	URS, BWSC meter readings x 200%
12 - 22 Babbitt St., 8 St. Mary's Street	4,500	Cannon/310 CMR 15.00 DEP-Title V
110 - 112 Cummington St.	11,085	URS, BWSC meter readings x 200%
Total Flow	**68,589**	

* Where water meter readings were used, maximum daily use was based on an average taken over a minimum of the previous twelve months for use in the analysis.

Due to the variability in sewage flows and to assure that maximum or peak flows are represented, the calculated flow is increased by an assumed factor of 3.0 which represents a ratio of maximum to the average for residential wastewater flows. Thus for analysis purposes, a flow of 68,589 x 3.0 = 205,767 GPD will be used to evaluate the current usage.

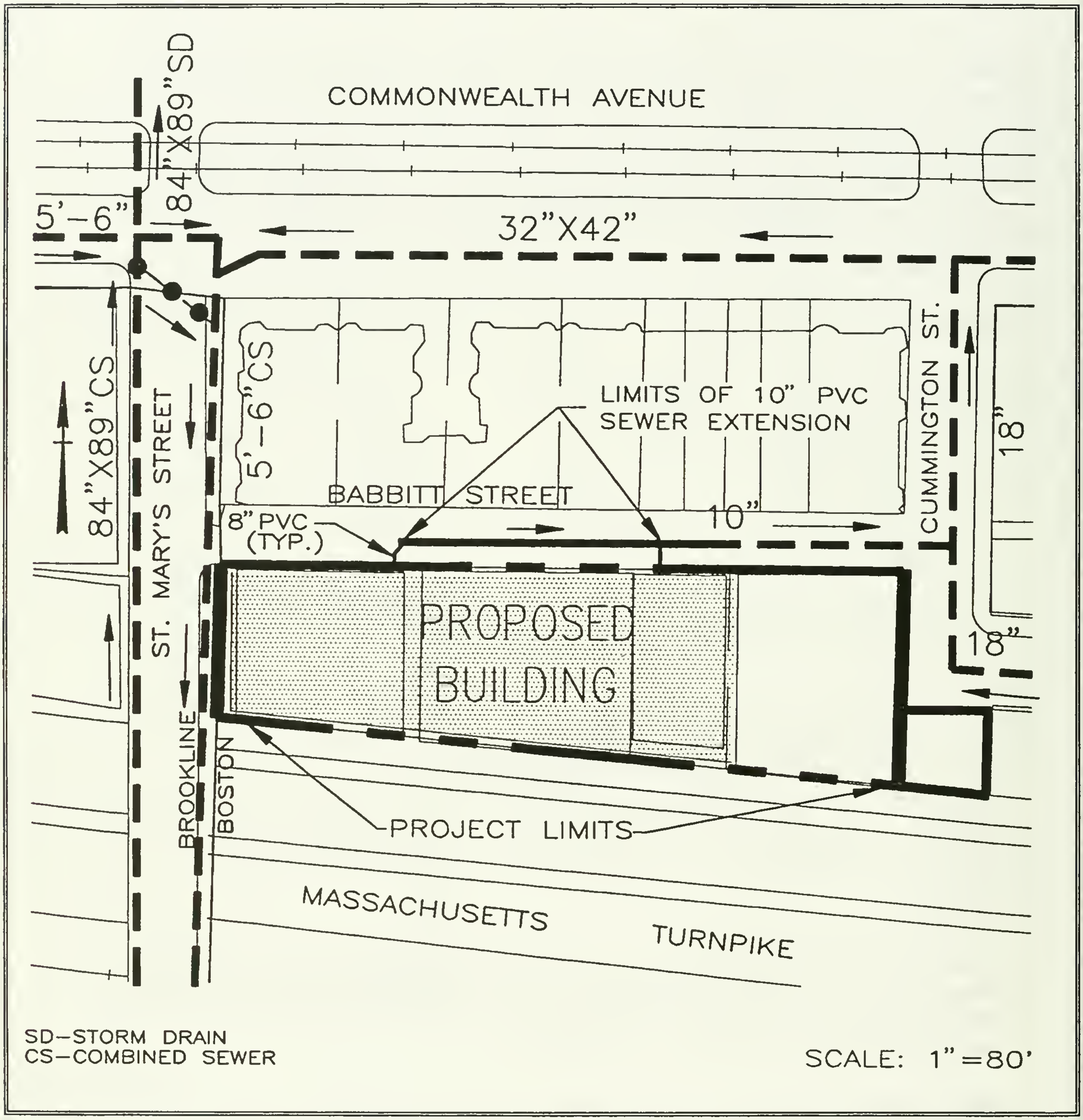
Therefore, the results of the analysis show that the 10-inch sanitary sewer currently operates at approximately 22% of capacity at .33 CFS where the pipe has a flowing full capacity of 1.52 CFS.

Project Impact

The estimated total wastewater flow for the project has been generated based on the DEP flow guidelines (314 CMR 7.00). Based on these assumptions, the proposed building is estimated to generate approximately 10,910 GPD. This represents a net increase of approximately 6,410 GPD over existing flows from the buildings to be demolished.

Applying the peak factor of 3.0 to the net increase in flow yields 19,200 GPD to be added to the existing flow which then increases the operational level to 24% of the pipe's capacity.

Service connections will be made in two locations to service flows from the building (see Figure 14-4). It is proposed to extend the existing 10-inch sanitary sewer line westerly to a point approximately 150 feet west of its current terminus. A 10-inch PVC pipe will be used for the



New Sanitary Sewer Connections

Prepared By: URS Consultants	*Figure 14-4*

sewer extension. The two service connections to the new building will be 8 inch diameter PVC pipes.

14.4 STORM DRAINAGE

Existing Condition

The project site is currently occupied by four buildings, three of which will be demolished. 12 Babbitt Street, 18-22 Babbitt Street, and 8 St. Mary's Street will be demolished to make way for the new Research Center. The site is currently covered by buildings, except for the small open space which is largely paved. Presently, storm water collected on the roof of 12 Babbitt Street flows by a 12-inch roof leader to a manhole in Babbitt Street. This manhole is shared by a 10-inch sanitary sewer and a 15-inch storm drain. From the manhole the 15-inch storm drain flows easterly to Cummington Street where it connects to a 20-inch x 30-inch-storm drain (see Figure 14-5).

Surface runoff from Babbitt Street is also collected in the 15-inch storm drain by way of a catch basin on the North side of Babbitt Street. The 20-inch x 30-inch storm drain begins as a 10-inch storm drain in front of 112 Cummington Street and flows northerly to the 32-inch x 42-inch sewer line which flows westerly along Commonwealth Avenue. As described in the sanitary sewer section, this sewer line then flows to the 5 - 6-inch MWRA Charles River Valley Sewer. There is a second 15-inch storm drain that runs east/west along Cummington Street, turning north with Cummington and collecting surface runoff from catch basins on Cummington Street.

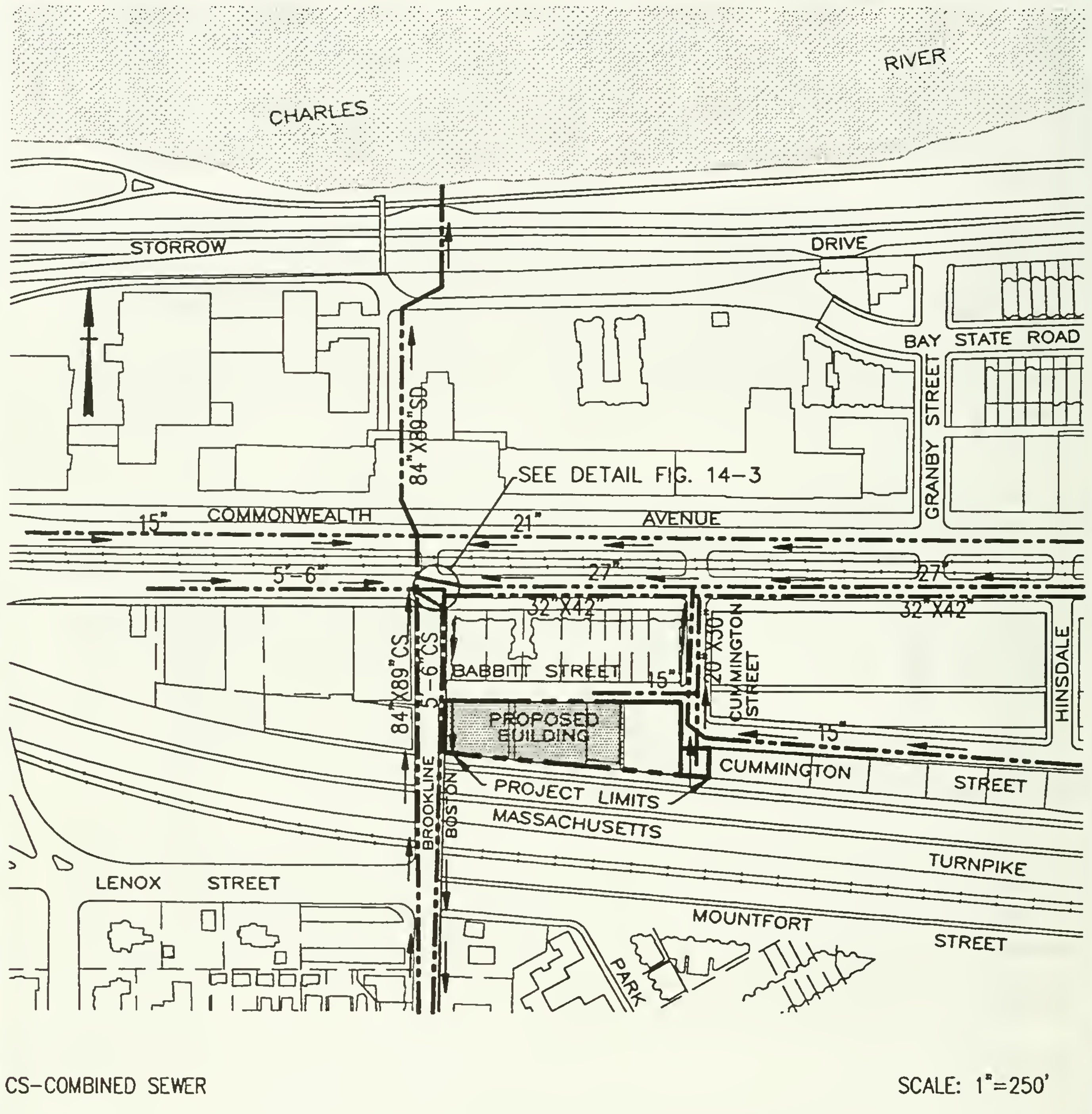
This second 15-inch storm drain flows to a 27-inch storm drain in Commonwealth Avenue. This 27-inch storm drain flows westerly along Commonwealth Avenue to the 84-inch x 89-inch storm drain which runs north and outfalls to the Charles River as described earlier.

Hydrologic and hydraulic analyses were conducted for the 15-inch storm drain in Babbitt Street to establish current usage. The 15-inch storm drain was found to be operating at approximately 78% of capacity for a 10 year storm event. Surface runoff from Babbitt Street accounts for approximately 34% of capacity while roof drainage from 12 and 18-22 Babbitt Street buildings account for the remaining 44% of capacity. These buildings will be removed to make way for construction of the Center for Photonics Research.

Project Impact

The overall area of impervious surface will not increase due to the project. Therefore, no net increase in stormwater runoff is anticipated. However, the entire roof area runoff from the Research Center building will be discharged to the Babbitt Street system by way of two roof leader connections.

As stated under existing conditions, the existing 15-inch storm drain currently operates at 78% of its capacity based on the assumption that only 12 and 18-22 Babbitt Street currently contribute to



Existing Storm Drainage Distribution System

Commonwealth Ave. Area

Prepared By:

URS Consultants

Figure 14-5

the Babbitt Street system. That roof area (.36 acres) plus the street area (.28 acres) give a total impervious drainage area of .64 acres. The proposal to drain the entire roof of the Research Center to Babbitt Street results in an increased roof area contribution to the Babbitt Street system from .36 acres to .61 acres. Add to this the .28 acres of street surface area, and the new total area is .89 acres. The increased flow from this area will be 4.57 CFS which surcharges the 15-inch storm drain which has a flowing full capacity of 4.23 CFS.

The Project will replace the 15-inch storm drain with an 18-inch storm drain to provide increased capacity. The 18-inch storm drain has a capacity of 9.10 CFS. The new 18-inch storm drain will operate at 50% of capacity after the Project is completed. Service connections will be made in two locations to service flows from the building (see Figure 14-6). The connection of the new 18-inch storm drain will connect to the existing 20-inch x 30-inch storm drain in Cummington Street. This proposal is currently under review by BWSC and may be subject to change.

Water Quality Protection

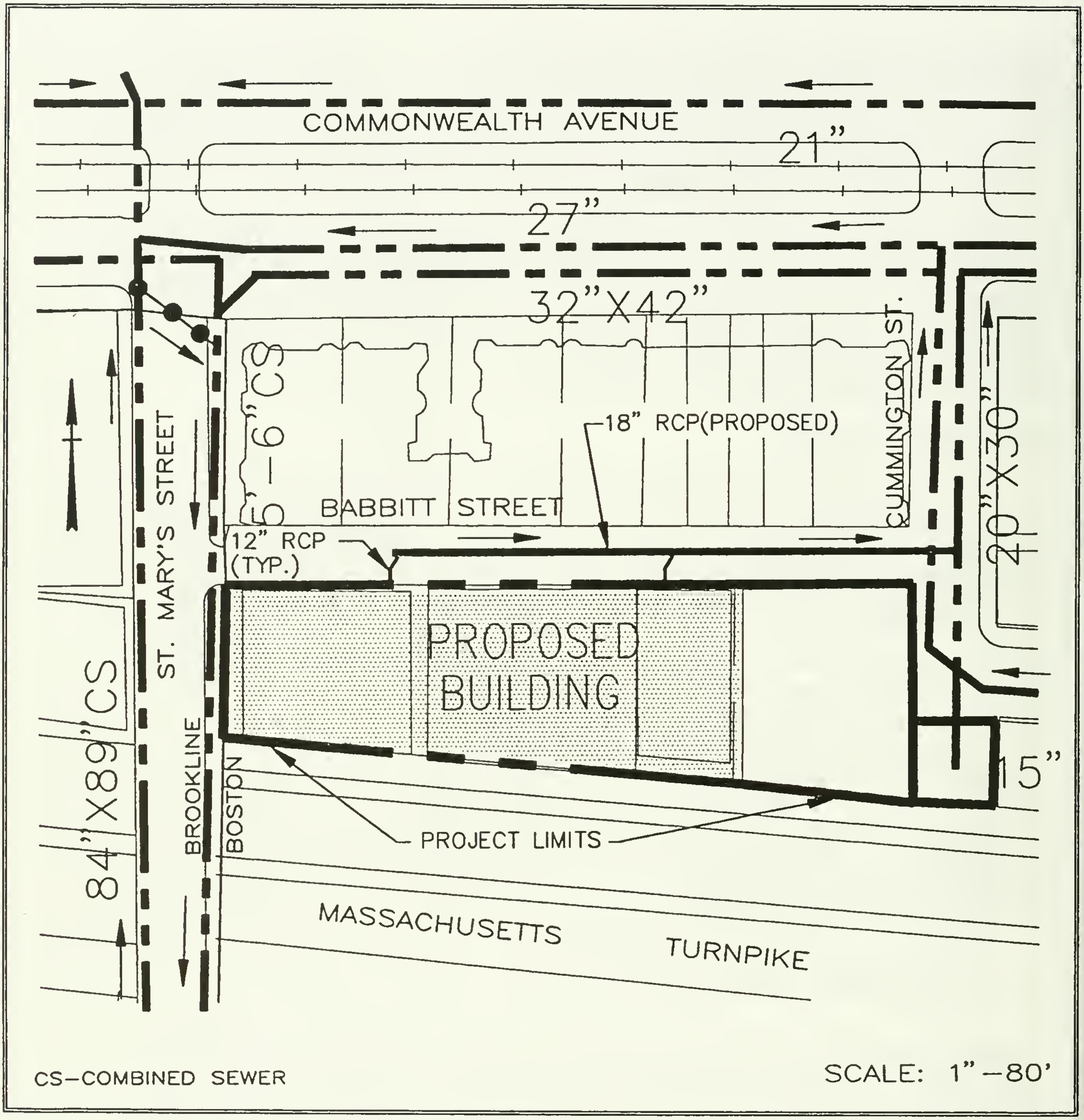
The Project will not result in degradation of water quality compared to existing conditions. There are no existing parking facilities on site and none are planned. The site currently has three buildings discharging roof runoff to the storm systems within the Project area. These three buildings will be replaced by the new Research Center, and roof runoff will connect to an upgraded separate storm drain system. Sanitary sewage will connect to a separate sanitary sewer.

The 10-inch sanitary sewer and 15-inch storm drain which presently connect jointly to a manhole in Babbitt Street will be separated as a result of the Project and stormwater and sanitary sewage will be discharged to separate systems in Babbitt Street.

Stormwater catch basins will be equipped with sumps and grease and oil separators. All stormwater inlets, improvements and connections will comply with the rules and regulations of the agencies having jurisdiction including, BWSC, MWRA and the Town of Brookline. Measures to trap sediments, such as hay bales or on site sedimentation pits will be used to effectively control the quality of runoff during construction prior to collection by the storm drainage system (see Chapter 15.0, Construction).

14.5 ELECTRICAL SERVICE

Boston Edison is currently reviewing requirements to provide two medium voltage 13.8 KV utility services. One of these services will be the preferred service, the second will be an alternate. These services will be connected to a new medium voltage service entrance switchgear lineup located in the basement level of the Research Center. Demand is anticipated to be 4,110 KW. Connected load is approximately 5,871 KW. The demand includes service to the Research Center and also the 110-112 Cummington Street building.



New Storm Drain Connections

Prepared By:
URS Consultants

Figure 14-6

The proposed distribution system will provide two main double ended 480Y/277 volt secondary unit substations to handle the entire building. They will be separated by a load such that one substation will handle primarily mechanical and elevator loads and the other substation will handle normal building loads. The estimated size of the two basement level substations is for two each 2500OA/3333FA KVA.

The secondary (600 volt) distribution system will be designed to respond to the power needs for the new building and will allow flexibility to accommodate future space/function changes. The distribution voltage at each unit substation will be 480 volts, 3 phase, 4 wire plus ground. This will provide service to equipment and lighting loads. This voltage will be further transformed down to 208Y/120 volts, 3 phase, 4 wire for receptacles, miscellaneous equipment, etc.

Emergency power will be provided by a 1000 KW diesel engine driven, water cooled engine generator set, located within the penthouse area. A dual transfer pump wet and two 6,000 gallon tanks, located in the basement level, will provide fuel for emergency power and boiler systems. This system will provide in excess of 7 hours of capacity. A 150-gallon day tank will provide for additional fuel capacity at the generator set. The generator loading is estimated to be 900 KW and will serve emergency lighting, fire pump, one elevator in each bank, sump pumps, emergency laboratory loads, atrium smoke exhaust systems, and fire protection alarm systems. A remote generator plant annunciator will be provided at the grade level fire command center for system monitoring.

14.6 GAS

The central steam boiler plant will be fired by natural gas with No. 2 oil as an alternate standby. Natural gas will also be piped to points of use in the building's laboratories.

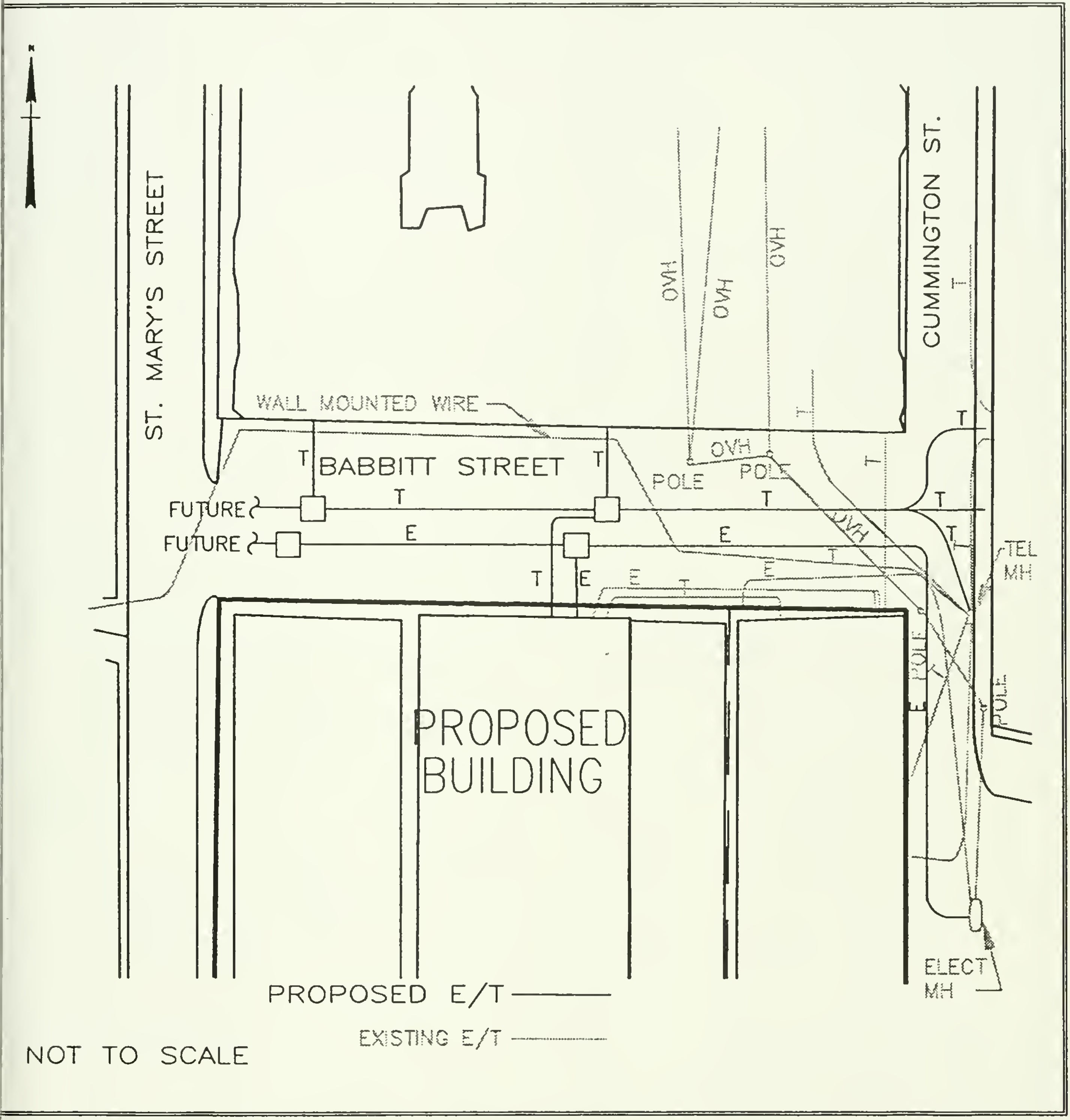
The projected peak demand for the natural gas is 30,300 cubic feet per hour. Boston Gas Company is currently reviewing the service requirements. The exact connection design has yet to be finalized in conjunction with Boston Gas. The demand includes service to both the Research Center and the 110-112 Cummington Street building.

14.7 TELEPHONE AND DATA SERVICE

The proposed services and internal network of the Research Center will be extended from an existing Cummington Street underground duct bank system to a telecommunications service room located on the north facing the Babbitt Street basement level. NYNEX and Boston University telephone and data truck lines will be extended through this railway system to service the Project. Service connections to the 110-112 Cummington Street building will be consolidated and upgraded as a result of the Project.

14.8 CONCLUSION

The utility demands of the Project can be met by existing public and private utilities systems. Initial conversations with BWSC and MWRA indicate no known problems. All water and sewer connections will be constructed in conformance with the BWSC and MWRA requirements. Storm drain and water lines immediately serving the site will be upgraded as a result of the Project. Private utility providers have also been contacted and indicated no immediate concerns.



New Electrical & Telephone/Data Connections

Prepared By: URS Consultants

Figure 14-7

15.0 CONSTRUCTION IMPACTS

15.0 CONSTRUCTION IMPACTS

15.1 INTRODUCTION

This chapter addresses construction of the Boston University Center for Photonics Research project including scheduling, staging areas, traffic, air and water quality, noise, excavation, and rodent control. Construction impacts are not anticipated to be unusual for this Project. The University will work closely with Boston and Brookline officials regarding construction management and will strictly adhere to applicable City of Boston and Town of Brookline regulations.

A number of documents will be prepared for approval detailing construction methods and potential mitigation for construction impacts. These documents are a Construction Management Plan, a Disposal Management Plan, and an Integrated Pest Management Plan.

15.2 SCHEDULE AND HOURS

Construction is currently scheduled to commence early in 1995 and be completed by the end of 1996. Typically, construction takes place on weekdays between the hours of 7:00 AM and 3:30 PM. Construction hours for the Project may vary. If the need for overtime and/or weekend construction work arises, it will be pre-scheduled in order to avoid conflicts, and appropriate permits will be acquired.

Scheduling of materials being delivered to and taken from the site by truck may have a significant affect on traffic. Construction activities will be scheduled to avoid local traffic conflicts as much as possible and will be specified in the Construction Management Plan.

15.3 PUBLIC SAFETY AND PEDESTRIAN ACCESS

No disruption to pedestrian traffic along St. Mary's Street and Cummington Street is anticipated. Pedestrian traffic along Babbitt Street will be routed through a marked and barricaded pedestrian walkway (see Figure 15-1). During non-construction hours, construction site security will be maintained by Boston University's campus security forces.

15.4 TRAFFIC AND TRUCK ACCESS

The majority of construction truck traffic is expected to enter the site from Cummington Street via Commonwealth Avenue. The number of trucks on site will be minimized by using the Boston University Armory site (899 Commonwealth Avenue) as a temporary staging site. A limited number of construction activities may require a police detail at Cummington Street, St. Mary's

Street, and/or the Massachusetts Turnpike. Some construction activities may require the use of the breakdown lane of the Turnpike. These construction activities will have no direct impact on local streets. Details of truck and general traffic controls will be included in the Construction Management Plan required by the City of Boston.

Street closures are expected to be minimal, if at all. Vehicular access to Commonwealth Avenue properties abutting Babbitt Street will be maintained. If necessary, alternate arrangements will made for those short periods access may be disrupted.

15.5 STAGING AREAS AND WORKER PARKING

The Center for Photonics Research project site offers limited construction staging capacity compared to other city construction sites. Therefore, it will be necessary to use alternate locations for staging and worker parking. Staging will be located on the Project site, to the greatest extent possible, and also on the Armory site at 899 Commonwealth Avenue.

The work force on-site during the construction period is expected to vary with a peak of approximately 100 to 150 people, including construction workers, architects, and engineers. As per City of Boston requirements, it is assumed that 50% of the workers will be Boston residents and, because of the site's excellent accessibility via public transportation, a large number of these workers will commute via public transit. To help achieve this goal, the University will subsidize construction worker MBTA passes for the duration of the construction period. Worker parking is anticipated to be located at the Armory site and other nearby parking facilities controlled by the University. The Construction Management Plan will include a worker parking plan.

15.6 AIR QUALITY AND DUST CONTROL

The generation of potential air emissions during construction of the Research Center is expected to be minimal. Principally, emissions will be comprised of fugitive dust from demolition excavation and exhaust gases from construction equipment.

Construction equipment will be maintained in good working order so as to maximize engine efficiency and reduce the emission of pollutants. Details of air quality control measures associated with construction will be included in the Construction Management Plan.

Fugitive dust will be controlled by means of the periodic application of environmentally benign wetting agents. Further, as soon as practicable, all exposed areas either will be temporarily stabilized (through the use of straw or jute matting, for example). In order to reduce dust and debris in the surrounding area, only licensed commercial haulers using covered trucks will be used to remove construction debris.

15.7 WATER QUALITY

For construction of the Project, dewatering activities will be required during the site preparation and foundation construction phases. During construction of the Project, there will be a negligible effect on water quality in the area. The stormwater and groundwater that collects within the excavation support walls will be collected and, if necessary, treated in accordance with the requirements of the BWSC and/or MWRA requirements prior to discharge into the stormwater system.

15.8 NOISE AND VIBRATION

The Project is in an urban area with high ambient noise levels. Sensitive receptors in the immediate vicinity of the Project site include the residences abutting Babbitt Street. Efforts will be taken to minimize noise and vibration impacts. Boston University is the owner of a large majority of adjacent residential and academic buildings and is therefore concerned about the need to minimize noise and vibrations associated with construction.

Vibration that will occur during construction will be caused primarily by demolition of existing structures and by the installation of soldier or sheet piles associated with excavation support and compaction of backfill. At this time, both a mat and pile foundation system are being considered for the Research Center. If a pile system is used, impact pile driving will likely be required. Appropriate measures will be taken to protect adjacent structures and utilities from potential impacts associated with pile driving.

All construction work at the site must be performed in accordance with the Regulations for Control of Noise in the City of Boston. In addition, the Construction Management Plan will include criteria for construction noise and vibration, particularly during sensitive hours and for noise sensitive abutters. It will stipulate protocols to be followed by the contractors in order to manage noise at the Project site. Among other things, it will define construction hours, truck routes, procedures such as the periodic inspection of mufflers to ensure their proper operating condition, and procedures for monitoring vibration.

To the extent practicable, the staging of construction equipment at the site will be undertaken with consideration for potential noise impact on adjacent land uses. Compressors, pumps, and similar pieces of equipment, which remain relatively stationary throughout the construction period, will be located away from residential uses and other sensitive receptors to the extent possible.

15.9 GEOTECHNICAL IMPACTS

The foundation design for the Research Center building has not yet been finalized. As mentioned above, both mat and pile foundation systems are contemplated. Initial field work indicates groundwater to be approximately El. 7. Accordingly, temporary dewatering will be required inside the excavation limits. Measures, such as underpinning, will be taken to protect the 110-112 Cummington Street building. Other excavation support measures will be taken to protect utilities on and near the site (see Chapter 11.0, Geotechnical Impacts).

Careful coordination with the City, public, and private utility companies will be employed to avoid unnecessary disruption in service.

15.10 DEMOLITION AND EXCAVATED MATERIAL

The construction of the Research Center involves the demolition of approximately 22,200 cubic yards of demolition debris associated with the removal of buildings at 8 St. Mary's Street and 12 - 22 Babbitt Street. The debris will consist of masonry, concrete and structural steel. Oil tanks on site and asbestos in the buildings will be removed by licensed contractors prior to demolition. The demolition will be performed by a licensed demolition contractor in accordance with applicable state and local regulations. All debris will be removed from site and disposed in a licensed solid water facility or an approved recycling facility.

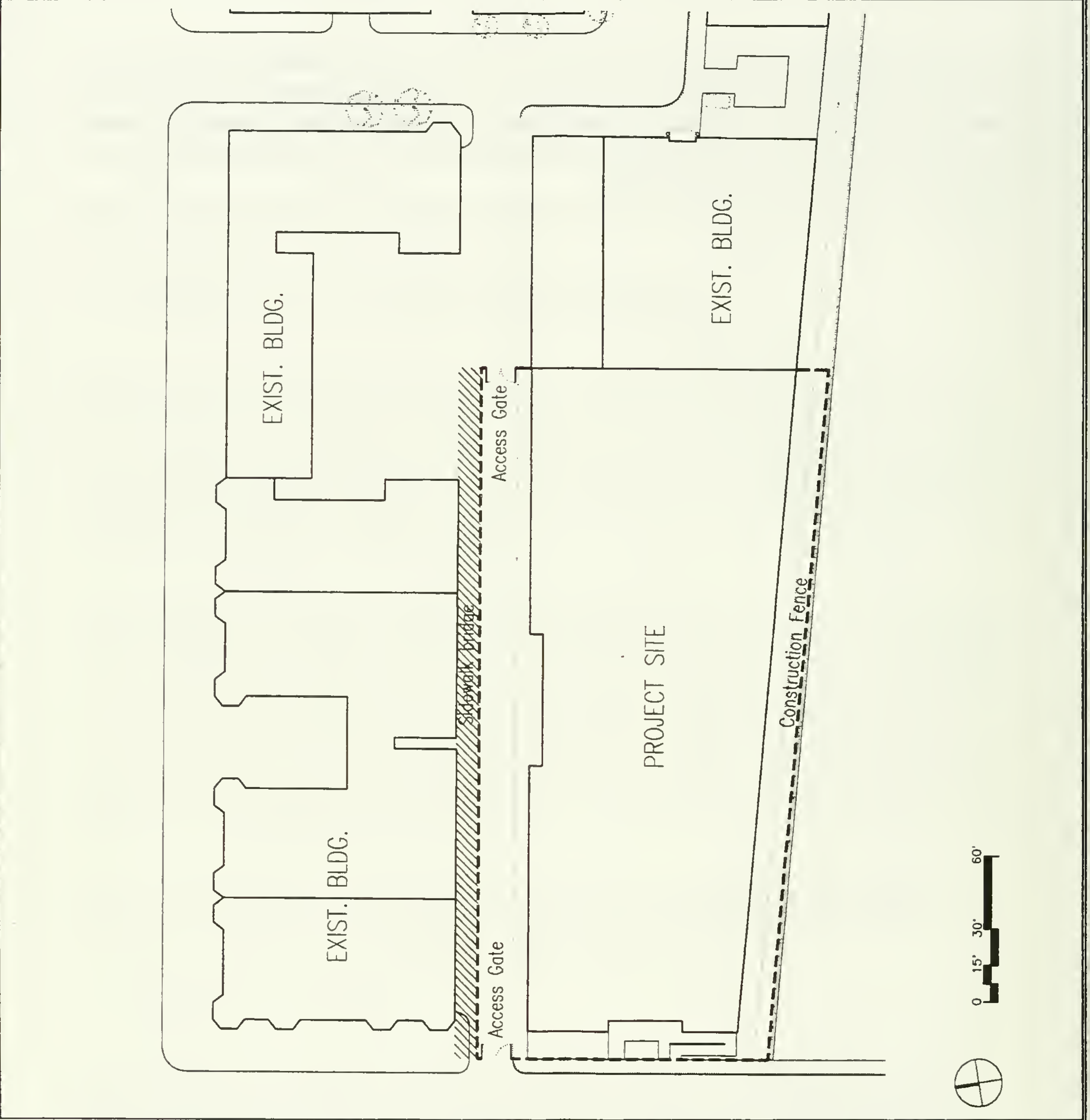
The new building will involve excavating approximately 6,000 - 10,000 cubic yards of soil beneath the existing buildings depending on foundation type. Due to site limitations, it will not be practical to stockpile excavated material on site. In order to remove from the site quickly, soils testing is currently being conducted to identify the presence of hazardous materials (see Chapter 9.0, Soil and Hazardous Waste). Advance testing will allow soils to be loaded directly onto trucks and moved off-site immediately upon excavation. The handling and location for disposal will be determined by a Licensed Site Professional based on test results. Preliminary estimates indicate that approximately 300 - 500 truck trips will be required remove excavated material assuming 20 cubic yards per truck.

Similarly, tests are also being conducted on site to characterize groundwater and develop a suitable disposal plan. If warranted, the groundwater can be pre-treated prior to discharge into the nearby storm drain system, reinjected, or disposed off-site.

15.11 RODENT CONTROL

Norway rats (Ratus norvegicus) and house mice (Mus musculus), the rodents most common to the Boston area, generally inhabit surface and subsurface areas around available food sites. Construction activities disturb these habitats by eliminating food, shelter, and movement routes. At construction sites where existing buildings must be demolished, rodents can be a serious problem.

An Integrated Pest Management Plan, coordinated with the current Boston University campus program will be established prior to construction. This plan will detail measures to be taken that will reduce the rodent population prior to construction, and will include measures that address sanitation, rodent proofing, and poison baiting. Licensed pest control professionals using registered rodenticides will undertake poison baiting prior to construction and at regular intervals during construction. Public education and strict monitoring of the poisons used is expected to reduce the chances of harm to people and pets.



Access and Pedestrian Protection Plan

Prepared By:
Cannon

Figure 15-1

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Appendix C Draft Chemical Safety Guidelines

Appendix D Transportation

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Appendix A Social and Economic Impact

BOSTON
UNIVERSITY

Making A Difference
Economic and Social Impact Source Book
Fiscal Year 1992

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I. History and Overview

"In the heart of the city, in the service of the city" (Lemuel Murlin, President of Boston University, 1911 to 1925)

Boston University traces its origins to April 1839 when delegates of the Methodist Episcopal Church founded the country's first Methodist seminary. The seminary was established in Newbury, Vermont; transferred to Concord, New Hampshire in 1847; and to Boston in 1867, when it was chartered anew as the Boston Theological Seminary. In 1869, the officers of the Seminary were granted a charter by the Commonwealth of Massachusetts under the name Boston University.

Today, Boston University is made up of 15 schools and colleges: the School for the Arts, the College of General Studies, the College of Communication, the Goldman School of Graduate Dentistry, the School of Education, the College of Engineering, the Graduate School of Arts and Sciences, the School of Law, the College of Liberal Arts, the School of Management, the School of Medicine, Metropolitan College, Sargent College of Allied Health Professions, the School of Social Work, and the School of Theology. Boston University not only enjoys an outstanding reputation as a center of higher education and research, but also makes a substantial contribution to the City of Boston, the Greater Boston area, and the entire Commonwealth of Massachusetts in the form of jobs and direct spending, and through the many cultural, educational and social services which the University provides to its neighbors.

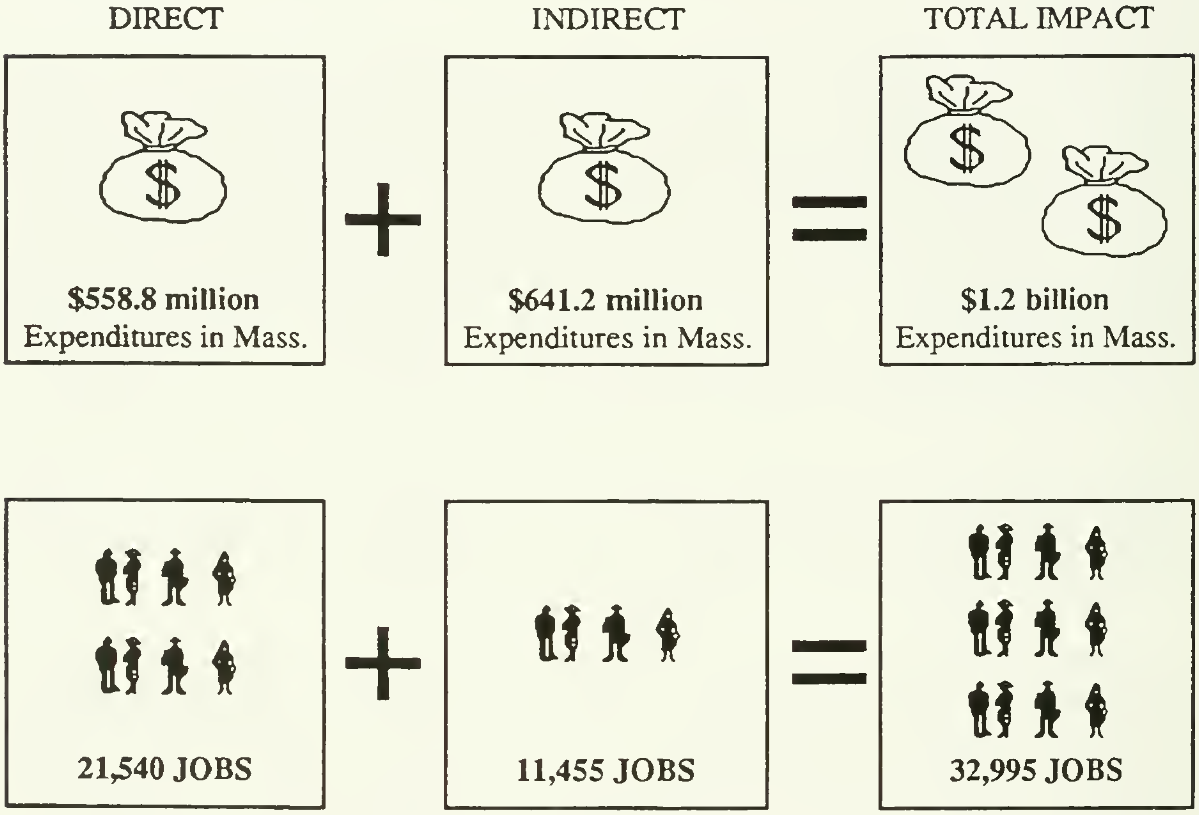
For over a century and a half, Boston University has been a major resource to the City of Boston, the Boston Metropolitan Area, and the Commonwealth of Massachusetts. Local citizens, organizations and businesses benefit from the proliferation of programs and services offered by University faculty, staff, and students. Boston University is proud of its commitment to the community — a commitment to making a difference.

The purpose of this report is to broaden community understanding about the significant contribution which Boston University provides to local citizens and businesses through its spending and services. **Section II** of this report was prepared by an independent consultant using a methodology developed by KPMG Peat Marwick for earlier Boston University studies. Here, the considerable positive economic impact of the University on the City of Boston, the Boston Metropolitan Area and the Commonwealth of Massachusetts is described in detail. In fiscal year 1992, the economic impact on the Commonwealth was $1.2 billion. The University directly employs more than 21,000 people, and the purchase of goods and services results in nearly 11,500 jobs for the Commonwealth.

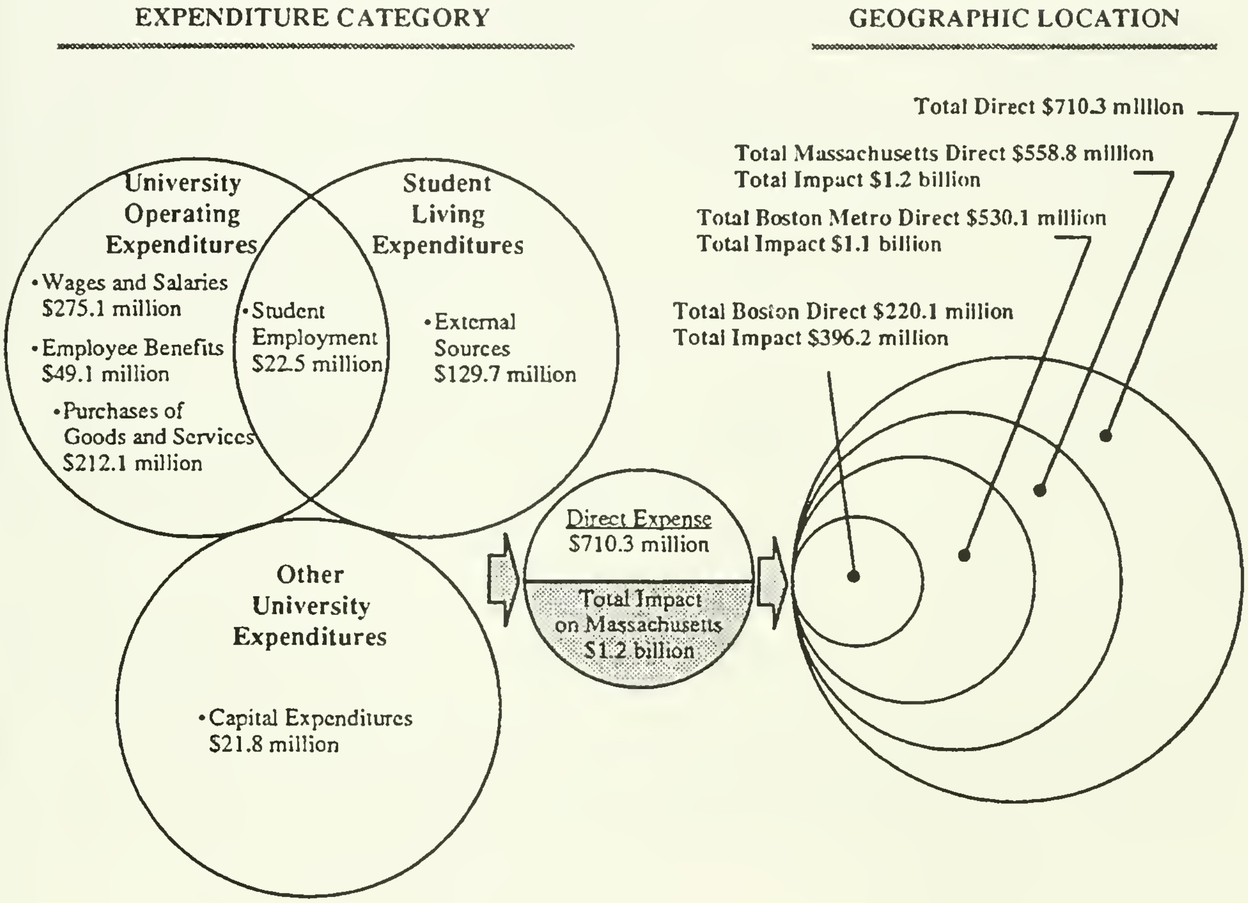
Numerous programs and services offered by Boston University have additional positive economic and social impacts on the area. These include: scholarships for the families of Boston fire fighters; free use of athletic facilities for high school competition and the Special Olympics; voluntary payments in lieu of taxes; tree planting; and the maintenance of sidewalks, streets, and MBTA tracks. **Appended** to the report is a reference guide (and index) to the many programs and services which Boston University provides to the community.

II. The Economic Impact of Boston University

During fiscal year 1992, Boston University and its affiliates and students expended $710.3 million, including $558.8 million in the Commonwealth of Massachusetts. Econometric factors provided by the U.S. Department of Commerce translate this direct spending into an estimated contribution of $1.2 billion plus nearly 33,000 jobs in the Commonwealth.



Of the $710.3 million spent during fiscal year 1992, $297.6 million was for faculty, staff, and student wages and salaries; $49.1 million for employee benefits; $212.1 million for purchased goods and services; and $21.8 million on capital projects. In addition, students brought an estimated $129.7 million into the area for living expenses. Seventy-nine percent of direct expenditures were made in the Commonwealth of Massachusetts ($558.8 million) of which $530.1 million was spent in the Boston Metropolitan Area, including $220.1 million in the City of Boston.


EXPENDITURE CATEGORY
GEOGRAPHIC LOCATION
University Operating Expenditures
• Wages and Salaries $275.1 million
• Employee Benefits $49.1 million
• Purchases of Goods and Services $212.1 million
Student Living Expenditures
• Student Employment $22.5 million
• External Sources $129.7 million
Other University Expenditures
• Capital Expenditures $21.8 million
Direct Expense $710.3 million
Total Impact on Massachusetts $1.2 billion
Total Direct $710.3 million
Total Massachusetts Direct $558.8 million
Total Impact $1.2 billion
Total Boston Metro Direct $530.1 million
Total Impact $1.1 billion
Total Boston Direct $220.1 million
Total Impact $396.2 million

The University's impact on the Boston, Boston Metropolitan Area and Massachusetts economies is much greater than the sum of direct University-related expenditures. The University's total economic impact is $396.2 million in Boston, $1.1 billion in the metropolitan area (including Boston) and $1.2 billion throughout the Commonwealth. A description of this "Multiplier Effect" which results in total impact will be found on page 10.

A. Sources and Uses of Operating Expenses

Total Sources and Uses of Funds by Boston University and its affiliates for fiscal year 1992 are presented in EXHIBIT 1.

EXHIBIT 1

Sources and Uses of Current Funds FY 1992

Sources of Funds ($000)		Uses of Funds ($000)	
Tuition and Fees	$380,419.5	Salaries and Wages to Faculty/Staff[a]	$275,075.3
Sponsored Programs:			
Federal Funding	60,154.5	Employee Benefits[a]	58,038.7
State Funding	2,335.4		
Local Funding	898.5	Purchases of Goods and Services[a]	212,085.0
Other	36,562.4		
Private Gifts and Endowments[a]	28,961.1	Student Employment	22,485.9
		Financial Aid	94,964.0
Sales and Services Departments:		Transfers/Adjustments[b]	36,696.0
Educational	26,282.9		
Investment Income	12,876.0	Net Increase in Funds Available for General Purposes	377.5
Auxiliary Enterprises	109,748.3		
Recovery of Indirect Costs	39,944.0		
Other	1,539.8		
Total Sources[c]	$699,772.4	Total Uses[c][d]	$699,722.4

(a) Includes contracted auxiliary enterprise services and/or Seragen, Incorporated.

(b) This amount includes transfers and adjustments which remain within the University system and thus are not expended in the local economy.

(c) The total sources and uses of funds include $14.9 million for Seragen, Incorporated.

(d) Uses of funds were reconciled to fiscal year 1992 audited financial statements.

Operating expenditures, funded largely from sources outside the Boston Area, have a direct and significant impact on the local and regional economies. For this study expenditures were analyzed and reported in five major categories: Faculty and Staff Earnings; Employee Benefits; Purchased Goods and Services; Student Living Expenses; and University Capital Expenditures.

This report focuses on spending in three geographic areas: Boston; the Boston Metropolitan Area; and the Commonwealth of Massachusetts, and includes data from: wholly-owned subsidiaries (Boston University Bookstore Mall and a real estate holding company); contracted food services (provided by ARA Services); parking services (provided by Fitz Inn Parking); and Seragen Incorporated.

B. Faculty and Staff Earnings

As shown in EXHIBIT 2, Boston University and its affiliates employed 10,694 faculty and staff in fiscal year 1992. Total wages paid to residents of the City of Boston amounted to $58 million. For residents of the Commonwealth of Massachusetts, total earnings were just over $261 million. The figures below do not include additional professional, consulting, publishing or lecture income earned by faculty and staff, or supplementary income earned by spouses or other family members.

EXHIBIT 2

Faculty & Staff Earnings FY 1992

Faculty & Staff	Home Location				Total
	Boston	Remainder of Boston Metro Area	Remainder of Massachusetts	Other	
Headcount	2,943	6,439	436	876	10,694(a)
Direct Salaries/Wages	$58,244,471	$190,932,601	$12,042,027	$13,856,156	$275,075,255

Total Boston Metro Area Earnings = $249,177,072

Total Massachusetts Earnings = $261,219,099

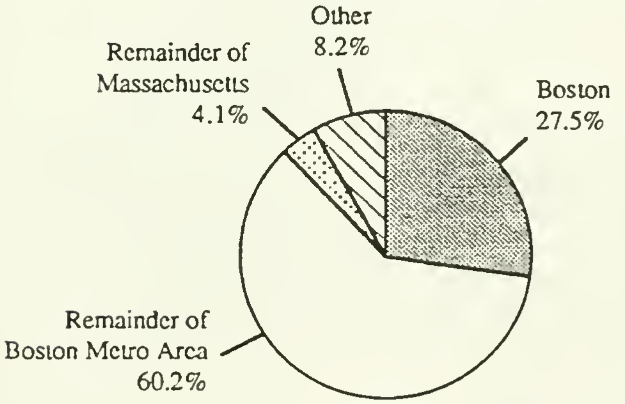
(a) Faculty and staff headcount includes:

*University**	9,587
Parking and Food Service Auxiliaries	418
Wholly Owned Subsidiaries	561
Seragen, Incorporated	128
	10,694

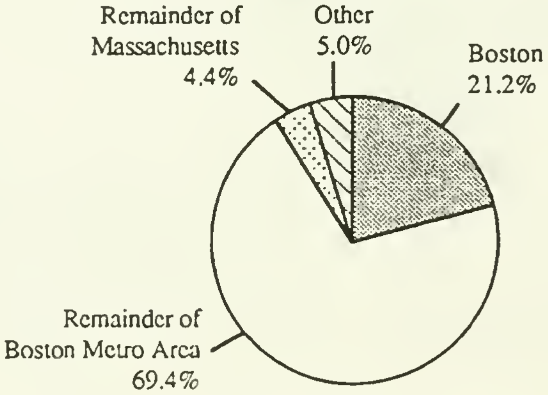
* *Does not include 10,846 students employed by the University (see Section II-E).*

A great majority of Boston University faculty and staff (87.7%) live in the Boston Metropolitan Area. They received 90.6% of total wages paid by the University.

FACULTY AND STAFF EMPLOYEES BY HOME LOCATION



FACULTY AND STAFF SALARIES AND WAGES



C. Employee Benefits

Boston University purchased a full range of benefits for its employees at a total cost of $49.1 million. Forty-one percent of this cost was spent on Workers' Compensation, Health Insurance, and Unemployment Compensation. As seen below, more than $4 million was spent in the City of Boston, and over $19 million in the Commonwealth of Massachusetts.

EXHIBIT 3

Employee Benefits Expenditures FY 1992

Benefits Expenditures	Home Location				Total
	Boston	Remainder of Boston Metro Area	Remainder of Massachusetts	Other/No Immed. Impact	
FICA(a)				$18,513,794	$18,513,794
Life Insurance(a)				699,507	699,507
Pensions(a)				14,098,967	14,098,967
Workers' Compensation(b)	$552,155	$1,807,526	$114,598	$130,225	2,604,505
Unemployment Compensation(b)	339,227	1,110,487	70,406	80,006	1,600,125
Health Insurance(b)	3,431,760	11,234,157	712,252	809,377	16,187,546
Tuition Remission				8,926,359	8,926,359
Other/Recoveries				(4,592,101)	(4,592,101)
Direct Expense Subtotals	$4,323,142	$14,152,170	$897,256	$38,666,134	$58,038,702
Adjustments(c)				(8,926,359)	(8,926,359)
Direct Expense Totals	$4,323,142	$14,152,170	$897,256	$29,739,775	$49,112,343

Total Boston Metro Area = $18,475,312

Total Massachusetts = $19,372,568

(a) *Funds paid to the federal government (FICA), the University pension program, and life insurance are saved/invested and do not impact the economy.*

(b) *Health insurance, workers' compensation, and unemployment compensation, totaling $20.4 million were distributed based on employee home location.*

(c) *This adjustment reflects the fact that tuition remission is a deferred expenditure, and therefore does not directly impact the economy.*

While tuition remission is a valuable benefit for employees and their families, it is not a direct expense for the University. Benefits such as retirement, social security, and life insurance, are saved or invested and have no immediate financial impact on the three geographic areas examined in this study. Therefore, in EXHIBIT 3 these costs are included with expenditures made outside the Commonwealth. However, if one assumes that many University employees choose to remain in Massachusetts after retirement, the *long-term* impact on Boston, the Metropolitan area and the Commonwealth is actually much greater.

D. Purchased Goods and Services

EXHIBIT 4

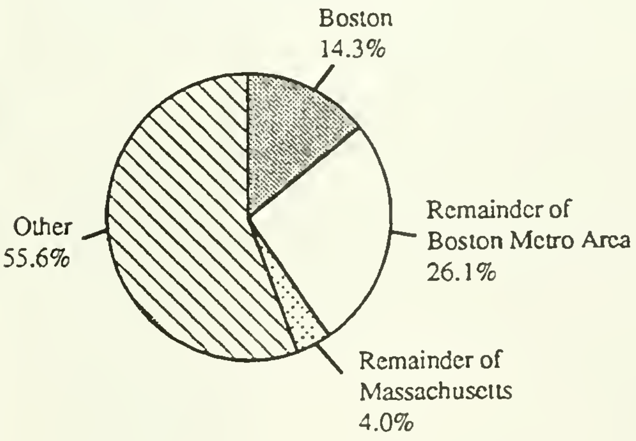
Purchases of Goods and Services FY 1992

Purchases of Goods & Services	**Business Location**				**Total**
	Boston	**Remainder of Boston Metro Area**	**Remainder of Massachusetts**	**Other**	
Number of Vendors	4,568	8,343	1,290	17,764	31,965
Direct Expenditures	$70,449,872	$57,245,554	$11,993,838	$72,395,707	$212,084,971
Total Impact on Boston Metro Area = $244,522,697	Total Boston Metro Area = $127,695,426				
Total Impact on Massachusetts = $282,149,646	Total Massachusetts =		$139,689,264		

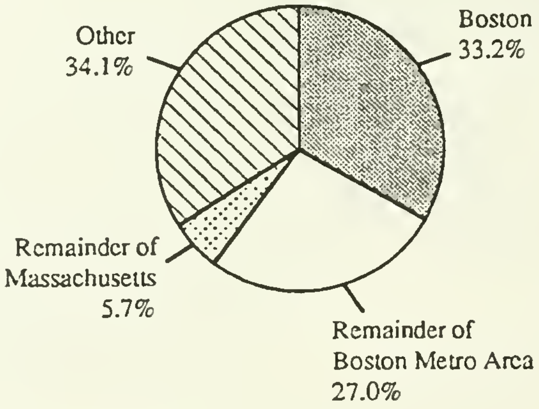
In fiscal year 1992, Boston University spent more than $212 million on a wide variety of goods and services, ranging from paper clips to trucks to sophisticated computer equipment. This direct spending translates into a total impact of $282 million when the economic multipliers for each industry are applied to purchasing from Massachusetts vendors.

Boston University makes a determined effort to patronize local vendors. Of the 32,000 vendors used, 40.4% were located in Massachusetts. These vendors received 65.9% of direct University expenditures.

VENDORS BY LOCATION



EXPENDITURES BY LOCATION



E. Student Living Expenses

Boston University enrolled 27,772 full- and part-time students in fiscal year 1992 (76% full-time). Fifty-nine percent of these students came from out-of-state. Thirty-five percent were enrolled in graduate or professional programs. Each full-time undergraduate spent an average $22,510 on tuition, fees, room and board (excluding financial aid). The University distributed $95 million in financial aid to 53% of all enrolled students. EXHIBIT 5 shows that 7,709 students lived in University residences and 20,063 lived off-campus (72%). Based on conservative average annual expenses for each type of housing, we estimate that Boston University students spent a total of $152 million for basic living expenses, transportation, and incidentals. The Multiplier Effect translates this spending into a total impact of $237.5 million in the metropolitan area.

EXHIBIT 5

Student Living Expenditures FY 1992

Student Expenditures	Residence Location								Total	
	Boston		Remainder of Boston Metro Area		Remainder of Massachusetts		Other			
	Full-time	Part-time	Full-time	Part-time	Full-time	Part-time	Full-time	Part-time	Full-time	Part-time
Number of Dormitory Residents	4,334	36							4,334	36
Number of College Apartment Residents	3,313	26							3,313	26
Number of Off-campus Undergraduate Students	3,271	220	1,301	285	119	30	1,683	117	6,374	652
Number of Off-campus Graduate & Non-degree Students	3,001	942	2,377	2,392	176	254	1,418	2,477	6,972	6,065
Total Number of Students	13,919	1,224	3,678	2,677	295	284	3,101	2,594	20,993	6,779
Total[a]	15,143		6,355		579		5,695		27,772	
Academic Year Budgets:[b]										
Dormitory Residents	$980									
College Apartment Residents	$3,750									
Off-campus Students-Undergrad.	$7,300		$7,300		$7,300		$7,300			
Off-campus Students-Graduate	$10,240		$10,240		$10,240		$10,240			
Part-time Students	$2,600		$2,600		$2,600		$2,600			
Direct Expense Totals	$74,403,690		$40,797,980		$3,409,340		$33,550,620		$152,161,630	
Total Impact on Boston Metro Area =$237,522,803	Total Boston Metropolitan Area = $115,201,670									
Total Impact on Massachusetts = $255,986,282	Total Massachusetts = $118,611,010									

(a) Based on Fall 1991 official mid-semester enrollment statistics. Students studying overseas are excluded.

(b) The standard student budgets for the 1991-92 academic year include living expenses, transportation and other incidentals. For purposes of this study, tuition, fees, room and board, and books have been excluded since they are paid to and expended by the University.

Throughout fiscal year 1992, the University employed a total of 10,846 students, providing approximately $22.5 million in wages. To cover all of their living expenses, students brought an additional $129.7 million into the area from non-University sources such as parental support, external employment, and loans.

Total Student Living Expenditures:	$152.2 million
From University wages/salaries for 10,846 students	22.5 million
From Non-University Sources	$129.7 million

F. University Capital Expenditures

During the past few years, Boston University undertook fewer major construction projects than in previous years. Nevertheless, in fiscal year 1992, it spent $21.8 million on capital projects. Contractors in the Boston Metropolitan Area received 89.4 percent of these funds. Applying the Multiplier Effect to these expenditures brings the *total* impact of capital spending in the metropolitan area to over $37 million.

EXHIBIT 6

Capital Expenditures FY 1992

Capital Expenditures	Business Location				Total
	Boston	Remainder of Boston Metro Area	Remainder of Massachusetts	Other	
Number of Contractors	87	129	16	50	282
Direct Expenditures	$12,649,368	$6,870,224	$432,268	$1,876,444	$21,828,304
Total Impact on Boston Metro Area = $37,393,424	Total Boston Metro Area = $19,519,592				
Total Impact on Massachusetts =$41,075,141	Total Massachusetts = $19,951,860				

G. Summary of Direct Expenditures

Direct expenditures by the University, its students and other University-related groups totaled $710.3 million in fiscal year 1992, with approximately 75 percent of these expenditures made in the Boston Metropolitan Area — thus having a significant impact on the economy. By applying economic multipliers to direct expenditures, we are able to determine the *total* economic impact on each area. The following pages explain the use of these multipliers and they show Boston University's total economic and employment impact in greater detail.

EXHIBIT 7

Summary of Direct Expenditures FY 1992

University-Related Expenditures	Location				Total
	Boston	Remainder of Boston Metro Area	Remainder of Massachusetts	Other	
Salaries and Wages to Faculty and Staff	$58,244,471	$190,932,601	$12,042,027	$13,856,156	$275,075,255
Employee Benefits	4,323,142	14,152,170	897,256	29,739,775	49,112,343
University Purchase of Goods and Services	70,449,872	57,245,554	11,993,838	72,395,707	212,084,971
Student Living Expenditures	74,403,690	40,797,980	3,409,340	33,550,620	152,161,630
University Capital Expenditures	12,649,368	6,870,224	432,268	1,876,444	21,828,304
Direct Expense Totals	$220,070,543	$309,998,529	$28,774,729	$151,418,702	$710,262,503
Total Impact on Boston Metro Area = $1.1 billion	Total Boston Metro Area =	$530,069,072			
Total Impact on Massachusetts = $1.2 billion	Total Massachusetts =		$558,843,801		

H. The Multiplier Effect

According to the U.S. Department of Commerce, the total impact on demand and employment of an institution such as Boston University is much greater than the sum of its direct expenditures. Each dollar may circulate through the economy several times, creating additional demand for goods and services, and generating jobs to supply those goods and services, until it is withdrawn through savings, taxes, and expenditures outside the region. Economists call this circulation the "Multiplier Effect" because the impact of each dollar is "multiplied" as it is spent again locally.

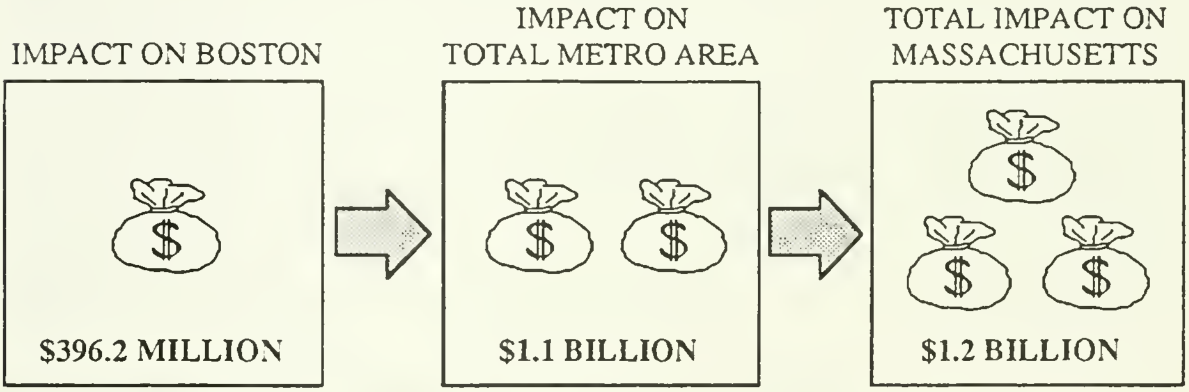
The Regional Input/Output Modeling System (RIMS II) developed by the Bureau of Economic Analysis, U.S. Department of Commerce, calculates output, earnings, and employment multipliers for 39 standard industries within regional and state economies. Each multiplier is determined based on the degree of "economic leakage" that could be realized as dollars circulate through the economy. For this report, output and employment multipliers for the Boston Metropolitan Statistical Area (MSA) and the Commonwealth of Massachusetts were obtained from RIMS II.

I. Total Economic and Employment Impact

The total financial impact of expenditures by Boston University, its students, and affiliated organizations is an estimated $396.2 million in the City of Boston; $1.1 billion in the Boston Metropolitan Area; and $1.2 billion in Massachusetts. EXHIBIT 8 shows the (weighted) average output multipliers resulting from the volume of expenditures in each of the specified industries: 1.8 for the City of Boston; 2.0 for the metropolitan area; and 2.1 for Massachusetts. The higher average multiplier for Massachusetts reflects the more "closed economy" of a wider geographic area. Expenditures circulate more times within the Commonwealth than they do within the City of Boston.

EXHIBIT 8

Economic Impact of Boston University FY 1992



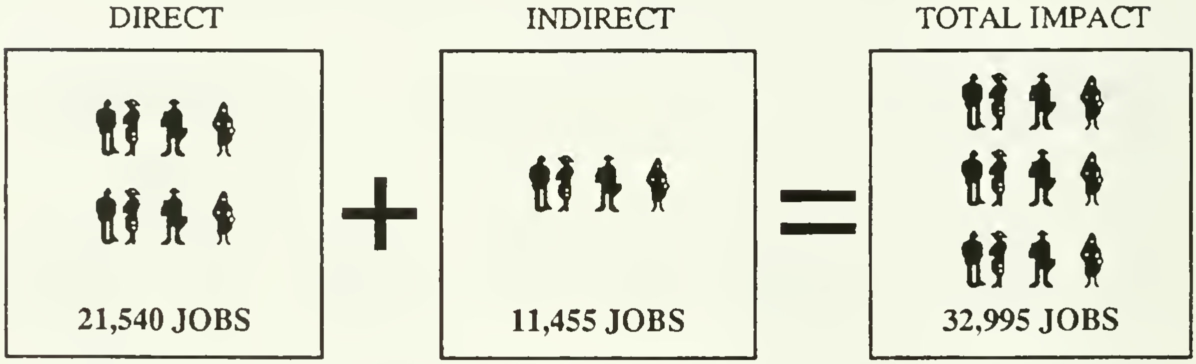
Average Output Multipliers		x	Direct Expenditures(a)	=	Economic Impact
City of Boston	1.8		$220.1		$396.2 million
Boston Metro Area(b)	2.0		$530.1		$1.1 billion
Massachusetts(c)	2.1		$558.8		$1.2 billion

(a) See Exhibit 7 for Summary of Direct Expenditures.
(b) Includes the City of Boston.
(c) Includes the City of Boston and the Boston Metropolitan Area.

In fiscal year 1992, the University and its affiliates employed 21,540 individuals with a wide variety of educational backgrounds and work experiences. Use of the RIMS II employment multipliers leads to an estimate that 11,455 additional jobs were created to support $1.2 billion of direct and indirect expenditures. Therefore, a total of 32,995 Massachusetts jobs result from Boston University's presence in the region — with 3,345 of these within the City of Boston. As with the output multipliers, average employment multipliers for the state are higher than those for the city.

EXHIBIT 9

Employment Impact of Boston University FY 1992



Average Employment Multipliers (Jobs per $1 million of expenditures)		x Direct Expenditures[b]	= Indirect Jobs
City of Boston	15.2	$220.1 million	3,345
Boston Metro Area[c]	17.7	$530.1 million	9,383
Massachusetts[d]	20.5	$558.8 million	11,455

(a) Based on University employment of:

• *Faculty and Staff -*	9,587
• *Students -*	10,846
• *Food and Parking Services -*	418
• *Wholly Owned Subsidiaries -*	561
• *Seragen, Incorporated*	128
Total	21,540

(b) See Exhibit 7 for Summary of Direct Expenditures.

(c) Includes the City of Boston.

(d) Includes the City of Boston and the Boston Metropolitan Area.

J. Generation of Additional Business Activity

Although the figures for the University's direct expenditures do not include local purchases by staff and students, they are, in reality, an important factor in the local economy. Many small businesses are located near the University to serve its population. These businesses, which include restaurants, clothing stores, book stores, copy centers, and pharmacies, provide jobs to local residents and add economic vitality to the area.

In addition, two independent organizations in the metropolitan area are so closely related to the University that, without its presence, they would not exist or would most likely be located elsewhere. These are: Seragen, Incorporated, and the Huntington Theatre Company.

SERAGEN, INCORPORATED is a biotechnology firm located in Hopkinton, Massachusetts. For the purpose of this study, calendar year 1992 expenditures of Seragen, Inc. have been included in the totals of University faculty and staff earnings, employee benefits, and purchased goods and services presented in Exhibits 2, 3 and 4, respectively. Normally, Seragen reports its financial results separately from those of the University.

Boston University is a major sponsor of the HUNTINGTON THEATRE COMPANY, a professional theatre company in residence at Boston University, which had operating expenditures of $5.3 million during fiscal year 1992. Financial information was not available on a geographic basis and was, therefore, excluded from the analysis of direct expenditures; these expenditures, however, did increase the economic impact of the University on the local, regional and state economies. For the 1992 theatre season, the Huntington Theatre Company had ticket sales totalling $2.8 million by 150,000 patrons.

K. Direct Payments to the City of Boston and the Town of Brookline

Property owned or leased by the University is legally exempt from property taxes. Nevertheless, the University has responded to the City of Boston's financial needs by paying taxes on certain properties acquired prior to 1980, by paying taxes on all properties purchased since 1980, and by making additional payments in lieu of taxes. Since fiscal year 1981 the University and its wholly-owned subsidiaries have paid over $16 million in property taxes to the City of Boston.

The University and it affiliates made the following direct payments to Boston and Brookline in fiscal year 1992:

- $331,386 payment to the City of Boston in lieu of taxes
- $1.9 million in real estate property taxes to Boston
- $402,714 in real estate property taxes to the Town of Brookline
- Over $577,000 to Boston for fees and permits, including building and inspection permits and parking and entertainment license renewals
- $15,238 to Brookline for licenses, permits and other town fees.

The above figures are included in total purchases of goods and services as shown on EXHIBIT 4 (page 7).

L. Attraction of Additional Financial Resources

The University's reputation as an educational and research institution attracts financial resources from outside the local area. For example:

- Boston University is ranked 57th among universities receiving federal research funding. In fiscal year 1991, the latest year that national figures are available, federal sources contributed approximately $60 million for research.

- In academic year 1991-1992, 58 percent of enrolled students were from out-of-state, bringing approximately $220 million in tuition and fees into the area. In addition, 3,833 international students from 128 countries attended Boston University.

- Landlords and businesses in the City of Boston benefited from 7,434 students who lived in the City. An additional 1,810 students lived in the Town of Brookline.

- Massachusetts lending institutions provided approximately $34.7 million in educational loans to University students during academic year 1991-92.

- EXHIBIT 10 illustrates the fact that alumni, friends, corporations and foundations located *outside* Boston donated nearly $30 million to the University, including $24.2 million from outside Massachusetts.

EXHIBIT 10

Private Voluntary Support FY 1992

Source	Home Location				Total
	Boston	Remainder of Boston Metro Area	Remainder of Massachusetts	Other	
Alumni	$479,003	$1,389,089	$262,275	$4,829,024	$6,959,391
Friends	435,338	1,962,424	159,411	2,843,668	5,400,841
Corporations and Foundations	2,075,638	1,756,249	57,424	15,427,911	19,317,222
Other	176,173	85,102	1,076	1,136,095	1,398,446
Total	$3,166,152	$5,192,864	$480,186	$24,236,698	$33,075,900

Total Support from Outside the City of Boston = $29,909,748

In addition, the University attracts thousands of people to the campus and neighboring communities each year in order to visit students, and to attend academic programs, athletic events, cultural and social events, alumni and class reunions, and Commencement activities. Visitors spend money for consumer goods, lodging, entertainment, food, parking, and gas. Although these purchases are not easily quantifiable, they are considerable, and flow directly into the local economy.

M. Additions to "Human Capital" - The Alumni

A degree from Boston University is valuable both to the individual obtaining the degree and to the communities where he or she lives and works. The economic value of a degree can be measured by estimating the increased earnings potential of degree holders and the corresponding additional economic activity they generate.

EXHIBIT 11 illustrates the fact that 34 percent of all Boston University alumni live in the Boston Metropolitan Area, and that 40 percent of all alumni live in Massachusetts. These alumni form part of a well-educated and highly skilled labor force.

EXHIBIT 11

Boston University Alumni FY 1992

Alumni	Home Location				Total
	Boston	Remainder of Boston Metro Area	Remainder of Massachusetts	Other	
Number of Alumni	9,887	55,035	12,215	116,789	193,926
	Total Boston Metro Area = 64,922				
	Total Massachusetts = 77,137				

The University attracts many out-of-state students to the Boston area. In the fall of 1991, almost 80 percent of entering freshmen were from outside Massachusetts. An analysis of freshman who first enrolled in September of 1981, 1983, and 1985 supports the long-held belief that many University students choose to remain in the Boston area after graduation. On average, 16.5 percent of the incoming out-of-state freshmen of the early to mid-1980's still reside in Massachusetts; with 5.8 percent still living in the City of Boston.

Data regarding University alumni income were not available. However, it is reasonable to expect that the increased earnings potential of University graduates, combined with the large percentage of alumni who reside permanently in local communities, increases the level of economic activity in the Boston Metropolitan Area.

N. Municipal Services

Boston University makes a significant contribution to the City of Boston by performing many municipal services which the City would otherwise have to fund itself. Examples include the following:

- The University employs its own police force, consisting of 39 police officers and 25 security guards who provide protection 24 hours a day, 7 days a week. The force serves as a deterrent to crime in neighborhoods close to the Charles River campus and also patrols the Medical Campus in the South End, reducing crime in that area.

- University Police provide backup assistance to the Boston, Brookline, and MDC Police when needed.

- Through a Ride-Along Program, the Director of Community Relations rides with Boston Police when responding to off-campus party and/or noise complaint calls on weekends. The Director has authority to discipline students when necessary.

- While patrolling the campus area the University Police issue parking tickets for the City of Boston. In fiscal year 1992, over 1,500 parking tickets, with an aggregate value of more than $48,000, were issued for the City.

- The University provides daily maintenance of sidewalks, MBTA tracks, and streets around the campus. At a cost of over $600,000 in 1992, the University repaired and cleaned sidewalks and streets, removed snow, and planted shrubbery.

- The University pays for City police and fire details during high attendance events. In fiscal year 1992, these payments totaled over $22,000.

- The University controls and manages its own rubbish removal, using private contractors. In fiscal year 1992, the University paid over $788,000 for these services at the Charles River Campus.

Boston University makes every effort to reduce its impact on traffic flow and available parking. Students are encouraged to live on campus or within walking distance. Through an on-campus MBTA Pass Program, University faculty, staff, and students are encouraged to use public transportation. A carpool program matches employees and students who live in the same community, and a shuttle bus is available for students who live off campus in the surrounding neighborhoods. The proposed development plan for the Commonwealth Armory property includes two-to-three levels of parking below the Armory, with a total of over 1,200 spaces.

III. Summary

This report was prepared to describe the economic benefits that Boston University provides to the City of Boston, the Boston Metropolitan Area, and the Commonwealth of Massachusetts. Highlights of this report include the following:

- A total of $275.1 million in salaries and wages goes to more than 21,540 faculty, staff and student personnel, 94 percent of whom live in the Boston Metropolitan Area.
- University direct and indirect expenditures for institutional operations, research, and community service yield a total estimated financial contribution of over $ 1.2 billion to the state's economy, of which $396.2 million is absorbed by Boston and $1.1 billion by the Boston Metropolitan Area.
- Direct and indirect employment resulting from University-related expenditures generate an estimated 33,000 jobs in Massachusetts.
- Additional financial support to the University from alumni, corporations, foundations, and others from outside the City of Boston brings in approximately $30 million.
- Massachusetts banks provide approximately $35 million in educational loans to University students.
- The University pays more than $2.8 million in taxes, fees and permits to the City of Boston and nearly $418,000 in real estate taxes and fees to the Town of Brookline.

Many community, educational, cultural, humanitarian, recreational and municipal services are either funded directly by the University or indirectly through foundation contributions, research grants, etc. Programs and services which impact the economy and quality of life in the Boston Metropolitan area include: neighborhood health centers, the Boston University/Chelsea Partnership, Boston and Brookline scholarships, academic enrichment and remedial help programs, a University-owned and sponsored radio station, free (or discounted) concerts and lectures, and recreational facilities made available for high school competition and the Special Olympics. A comprehensive, indexed list of these services is appended to this report.

Appendix: Boston University Community Programs

Services to Educational Institutions

A. Centers, Institutes, and Partnerships
B. Student Teacher Field Placements
C. Early Childhood and Middle School Programs
D. Secondary School Programs
E. Programs for Teachers and Administrators

Services to Other Non-Profit Institutions

A. Staff Training
B. Professional/Technical Assistance
C. Volunteer Staffing
D. Funding and In-Kind Donations

Services to Individuals and the Community at Large

A. Scholarship Assistance
B. Government and Community Affairs
C. Health Care Services
D. Dental Care Services
E. Athletics/Fitness
F. Adult Education Programs
G. Programs for Professionals
H. Programs for the Elderly
I. Programs for People with Disabilities
J. Mentoring and Counseling
K. Religious Education and Ministry
L. Legal Assistance
M. Charities/Community Action
N. Cultural and Intellectual Programs

Many of the University's volunteer opportunities within the community are coordinated by the Community Service Center, a student directed organization which participates in programs dealing with illiteracy, the homeless, the elderly, and the disabled. Their programs are described throughout this section.

Services to Educational Institutions

A. Centers, Institutes, and Partnerships

Boston University/Chelsea Partnership The University has entered into an unprecedented ten-year agreement to manage the Chelsea public school system. Chelsea schools and the children who attend them suffer from such problems such as a high dropout rate, low SAT scores, and a high teenage pregnancy rate. The University's comprehensive approach to the project involves students, faculty, and staff from many schools within the University, who provide educational, medical and management services. The University is committed to working with the Chelsea community to restructure and rebuild its school system. Since the program's inception, the annual high school dropout rate has decreased 10 points. [1992 direct University support: $732,000]

Boston Higher Education Partnership Formed in 1975, the Partnership contributes expertise and resources to the Boston public schools. Programs have been developed over the years to support and educate children, train teachers and administrators, and provide scholarship funds to make college a reality for thousands of Boston students. Boston University plays a leading role in this cooperative organization of 23 colleges and universities. In 1991-92, Boston University provided approximately 31 percent of all funding contributed by the Partnership, including more than $4.9 million in scholarships, over $1 million in *pro bono* services, and more than $1 million in external grants.

Boston University/Boston Schools Collaborative This Collaborative program provides a variety of services and access to University resources for selected Boston public schools. Services include technical assistance and professional development activities for teachers and school administrators.

School of Education Consortium Council The School of Education directs a consortium of seven local public school systems and eleven public agencies. Education students complete field work in a variety of settings offered by consortium members; the members advise on matters of curriculum reform and performance evaluations. In addition, Boston University has made money available to fund the educational programs of the consortium members. Recent programs include an after-school enrichment program, an artist-in-residence series, and exchange programs between inner-city and suburban schools.

The Urban Initiative In 1985, the Boston University School of Education, in collaboration with faculty of Wheelock College and Simmons College, founded The Urban Initiative to address the problems of urban schools. Projects of The Urban Initiative, which is directed by a Boston University professor, have included the design and development of a child care program which centers on education for children aged 3-6.

The Boston University Science and Mathematics Education Center In 1990, responding to the need for innovation in science and mathematics education, faculty at Boston University established the Boston University Science and Mathematics Education Center. This Center provides incentives for scientists and mathematicians to share their expertise with middle and high school teachers and their students. Faculty who initiate curriculum and educational projects in these areas receive support and encouragement from the Center, and local teachers, in turn, share their insights with University faculty.

The Boston University Center for the Advancement of Ethics and Character promotes the development of research, publications, and outreach programs that help school teachers become more competent and confident in the teaching and study of ethics and character. Faculty in the Center help schools take a legitimate and effective role in the development of ethical understanding in students.

The National Center for America's Founding Documents develops curricula and initiates activities that promote the study of America's Founding Documents. Because these papers embody and explain the philosophical foundations and structure of government in the United States, the Center works to broaden understanding of them as fundamental to a democratic society.

The Schools Reaching Out project seeks to foster academic and social success for children through the promotion of improved parent/school/community relationships. The project primarily targets low-income communities. Initial efforts in the David A. Ellis School in Boston have included the development of an on-site Parent's Center staffed by those involved in parent outreach.

B. Field Placements of Student Teachers

All students pursuing certification programs in the School of Education must complete a field placement in an appropriate school or community agency. The School has been linked with neighboring public schools since 1910, and has placed thousands of Boston University students in classrooms. In 1991-92, more than 900 students assisted teachers and social service agencies in the Boston area and throughout the world. In exchange, the University awards four-credit scholarships to cooperating educators, allowing them to pursue their own continuing education needs at the University. Additional scholarships are given to participating school systems and agencies for their discretionary use. During the past ten years, the University has provided over $1 million in scholarship aid through this program.

C. Early Childhood and Middle School Programs

Dental Health Plans for basic preventive care and dental services have been offered to Boston area public school students since 1985. Today, seventeen schools participate in a program offering their students biannual examinations and care on a prepaid plan at much lower cost than regular dental health plans.

Physical education instruction and supervised play has been provided by students from the School of Education for more than ten years to elementary school students at the Hamilton School in Brighton. A similar program was begun with the Gardner School in Allston in 1987. Buses are provided by the University to transport children to and from the Case Athletic Center for these programs.

The Early Learning Center is a public pre-school developed in 1987 by faculty in the Urban Initiative from Boston University and Wheelock and Simmons Colleges and by Boston school personnel. Serving children between the ages of three and six, the school is open year-round from 8 a.m. to 6 p.m., offering both instruction and day care. It has become a national model for early education programs.

The Educational Clinic, housed in the School of Education, has offered diagnostic assessment and remedial tutoring in reading to hundreds of students from Boston area elementary schools since 1932.

The Center for the Assessment and Design of Learning at the School of Education offers assessment services and educational recommendations to school personnel and parents of those elementary and secondary students who have special needs in reading and writing. It also offers professional development programs to several school systems.

The Bilingual Integration Pilot Program in the Shurtleff School in Chelsea brings together monolingual and bilingual children and teachers in mixed groups, without compromising the principles of bilingualism. All children in the school are integrated for academic and recreational activities, and their biculturalism is encouraged.

Engineering Open Houses are held several times each year by the College of Engineering to acquaint young students with the field of engineering and to encourage them to study engineering by showing the variety of research being conducted at the University. Students who visit these open houses from school systems throughout the Boston area meet undergraduates who may serve as role models.

Partners in Learning is a mentoring program pairing children from the Lewis Middle School in Roxbury with Boston University students who serve as role models. The program was honored by President Bush as a Point of Light in January 1991. The program is designed to work with at-risk youths to assist them in developing life strategies. Since 1988, Partners in Learning has served 100 students.

The Adopt-A-School Program made it possible for the Rho Sigma Chi fraternity at Boston University to adopt the Mary C. Burke Elementary School in Chelsea. In addition to providing physical improvements to the school, fraternity members take children to sporting events, run a Big Brother/Little Brother program, provide tutoring, and sponsor a variety of special events. A wider role for fraternity members is anticipated as they learn more about the school's needs.

The Mathlete's Convention at Boston University is attended annually by approximately seventy local seventh- and eighth-graders. Students compete in problem-solving math games. This convention was started in 1989 as a way to stimulate an early interest in mathematics.

Youth Tutoring is an after-school tutoring program for students between the ages of six and seventeen from the greater Boston area. Approximately fifty members of the Boston University Community Service Center have been offering this tutoring since 1987 and through it have enhanced the reading and math skills of hundreds of children.

Volunteer service in the Williams School involves thirty Boston University students each year who are taking a course entitled "Service in Schools." They work in this Chelsea school as a field component of their study of the values and processes of public service. The volunteers offer tutoring, enrichment opportunities, and help with paper work, and serve as role models for the elementary school children in the classrooms.

MASSPEP The College of Engineering participates in the Massachusetts Pre-Engineering Program, an after school program designed to encourage, motivate, and prepare elementary school students in Boston for careers in engineering, mathematics, and science.

The Meteorology Project in Chelsea has brought television meteorologists Bruce Schwoegler and Jack Borden together with School of Education science educators. They have given a series of lectures and have set up weather stations in every elementary school in Chelsea, as well as a computer terminal for the sixth grade in the Williams School. The group has developed teacher and classroom activities relating to weather and climate.

D. Secondary School Programs

Upward Bound/Project Advance This program provides academic enrichment and remedial help, on an annual basis, to approximately 60 Boston-area high school students through intensive classroom work during the academic year and a six-week residential tutorial program in the summer.

The Reading and Study Clinic The clinic offers individual reading evaluation and remedial help to middle and high school students and adults. Tutoring is offered at the School of Education by graduate students in the reading program. The clinic has served as a model for other such programs and has introduced hundreds of children and adults to a richer reading experience.

Contemporary Mathematics and Technology as a Driving Force for School Reform is an innovative program in the Mathematics Department to introduce high school teachers to revolutionary new ways to teach math. Begun in 1990, the program is currently working with forty to forty-five teachers who use the new curriculum ideas in their classrooms.

On Growth and Form is a program in the Physics Department that provides a series of workshops so that local high school students can learn about probability and fractal geometry by looking at random processes in nature. Through experiments, computer simulations, and computer games, students learn about the similarities of the microscopic and macroscopic worlds. Professors hope to develop a national curriculum based on this project.

Program in Mathematics for Young Scientists (PROMYS) is a six-week summer program for high school students from all over the United States. Students chosen on the basis of merit and potential attend classes emphasizing active problem solving, including the formulation, criticism, and modification of conjectures.

The Advanced Studies Program offers scholarships to up to twenty seniors from Brighton High School and English High School for one course at Boston University. Students who exhibit the potential to benefit from a college-level course are thus able to build their skills and gain credit toward a college degree. More than 135 students have received scholarships since 1984.

The Adopt-a-High School Program has enabled members of the Boston University Black Law Students' Association (BLSA) to help Brighton High School students evaluate their options for college and to prepare college applications. BLSA members plan to enlist other students at Boston University and to expand their efforts to other high schools.

College Preparation Workshops, offered by the Boston University Office of Undergraduate Admissions, help Brighton High School students evaluate colleges and submit applications. Workshops have been held since 1983. The University's Director of Financial Assistance runs an additional workshop for parents applying for financial aid.

Project STEP The String Training and Educational Program for minority students offers musical training to gifted Boston-area students. The program is a collaboration between the School of Music, The Boston Symphony Orchestra, and the Greater Boston Youth Symphony Orchestra.

Summer Training and Education Program for inner-city school students offers both remedial academic help and employment to approximately 50 students each summer. For seven weeks, students receive tutoring each day and hold down clerical or other jobs at the University.

The High School Honors Science and Engineering Program was started in 1978 to offer twenty to thirty highly talented high school juniors from throughout the country the opportunity to come to the University for six weeks in the summer in order to conduct serious scientific and engineering research. The program is funded by a National Science Foundation grant administered by Boston University.

E. Programs for Teachers and Administrators

Boston Leadership Academy offers advanced management training to current and likely future principals and headmasters in the Boston Public Schools. Each year, 35 participants attend weekly sessions, bi-weekly lectures, and day-long workshops to discuss issues of educational leadership. Since 1989,the Academy has provided training to those involved with the Boston Public Schools as part of a School-Based Management/Shared Decision Making program system-wide; training programs have reached more than 200 parents, teachers, and administrators from 32 schools.

The Microcosmos Project has developed a complete curriculum of hands-on science projects dealing with the world of microbes. Science educators visit the Microcosmos Science Education Museum in the School of Education. Since 1987, more than 75 middle and high school science teachers have participated in workshops. Another 500 teachers have attended lectures and joined the Microcosmos network of science educators.

Project Interact is a two-year federally-funded program to teach communication skills to elementary and middle school foreign language teachers. As part of the program, teachers of French and Spanish establish contact between their students and native speakers of these languages abroad or in local bilingual classes.

African Studies Center. The African Studies Center's Outreach Program disseminates information on Africa and African-related issues to the public and professionals, such as elementary and secondary school teachers, journalists, and museum specialists.

The Literacy and Language Institute offers assessment services and educational recommendations to school personnel and parents for elementary and secondary students, provides on-site and school-based educational update conferences and courses in literacy, and provides state-of-the-art information to professionals in the education of the deaf.

The Science Teacher Renewal Program has invited public school science teachers to come to Boston University for either a semester or a year of study with School of Education faculty and graduate students. Since 1985, a number of teachers have taken advantage of this opportunity.

The Institute for School Change is a project under the Higher Education Partnership involving the collaboration of eight colleges. Through a two-year program of training activities and assistance from colleges, the personnel of participating schools have engaged in planning changes in instruction. Since its inception in 1989, staff from 32 Boston Public Schools have been served.

Services to Other Non-Profit Institutions

A. Staff Training

The Fetal Alcohol Education Program at the School of Medicine has been training health care providers since 1974 in the early identification of families at risk for fetal alcohol syndrome. Professionals from the program give more than forty lectures and workshops annually to health centers and hospitals, in addition to offering information by telephone. The Program received more than 300 calls in a recent ten-month period during which it served individuals and agencies in the United States and several foreign countries.

The Alcohol and Drug Institute for Policy, Training, and Research teaches social services professionals about substance abuse and seeks to integrate substance abuse knowledge into mainstream Boston University courses. A year-long post-graduate certificate program has graduated 140 masters and doctoral level clinicians. Thirty professionals who have completed the institute's "Training of Trainers Program" provide substance abuse courses to a range of community agencies including health centers, hospitals, social service agencies, and school personnel.

Dorchester Alcohol and Drug Abuse Prevention Program funded by private foundations and corporations, was begun by the Alcohol and Drug Institute to provide substance abuse prevention training in Dorchester. Since 1989, several hundred Dorchester residents have received training. In December 1992, a multiethnic team of neighborhood residents which had designed and implemented programs addressing neighborhood needs, took over leadership of the project from Boston University, thus achieving one of the project's primary goals.

Project Visit is a support and training program for child care providers in centers and in family day care homes who care for children who may develop learning and behavioral problems. It is administered by Boston City Hospital and Boston University School of Medicine.

The Boston Area Health Education Center under the auspices of the Medical Center, has been working in urban neighborhoods for a decade. The Center develops educational programs that help to support the primary care practitioners who are already there and encourage medical and nursing students to go into primary care practice in the inner city. The Center arranges for medical students to provide services to the twenty-five **Neighborhood**

Health Centers throughout the city, which provide high quality primary health care in neighborhoods where it would not otherwise be available.

The Refugee and Immigrant Training Program, started in 1980 by the School of Social Work, has trained more than 280 Asian, Hispanic, Cape Verdean, and other immigrant paraprofessionals in the basics of human services. Individuals already working in the human service field learn the fundamentals of social work and analyze the delivery of social services in the context of their own cultures.

MIDST Program (Multicultural Issues/Diversity Studies and Training) offers a year-long course in multicultural clinical practice and a semester course in diversity management. It also offers diversity training and consultation to non-profit agencies.

B. Professional/Technical Assistance

PR Planners, a student public relations agency in the College of Communication, has been offering free public relations assistance to non-profit organizations for over a decade. An average of thirty students each year spend six to ten hours a week for one semester working on-site, devising publicity campaigns, developing public relations programs, arranging fund-raising events, and establishing media contacts.

AdLab is a professional advertising laboratory run by the College of Communication. Students in the school have developed and implemented advertising campaigns for more than 200 public service and non-profit agencies since 1975. Clients hire AdLab as they would hire any professional agency, and must have a budget capable of implementing the plan. However, they are charged only for out-of-pocket costs.

The Central Artery Tunnel Project was assisted by the Boston University Office of Public Archeology and the Center for Remote Sensing, who evaluated the archaeological significance of the area to be affected by the project. The study helped avoid possible destruction of significant archaeological artifacts, and actually led to the discovery of a number of items of significance, including a pier extending into the Boston Harbor that had long gone unrecorded.

Center on Work and Family, co-sponsored since 1990 by the School of Social Work and the School of Management, is the first university-based research organization studying work and home life issues. By means of demonstration projects, forums, and conferences, the Center educates policy makers in the public and private sectors on work/life issues.

C. Volunteer Staffing

Students from the Sargent College of Allied Health Professions have been serving the community since 1933. In any given year, seventy-five students work as physical therapists, speech pathologists, nutritionists, or occupational therapists. These unpaid professionals provide their services for forty hours a week, and from three to six months in area hospitals, rehabilitation and veterans associations, public schools, and other treatment centers.

Student Interns from the School of Social Work have been serving the community since the 1920s. Every year, more than 400 students work two or three days a week in non-profit social service agencies in the fields of mental health, child welfare, and services for the elderly or refugees. Students offer direct clinical services or work in community organization, systems management, or program planning.

The **Public Management Internship Program** is an opportunity for Public Management students to apply classroom learning to real-world problems, and to experience a managerial project in a public or not-for-profit organization. Examples of internship sites are: Cambridge Civic Association, La Alianza Hispaña, Environmental Futures, the City of Newton, and the National Trust for Historic Preservation.

Student Interns from the School of Education's Department of Special Education have been working in local schools and agencies for decades. Each year, about 30 students work full-time for one semester with children and adults who have physical or psychological disabilities.

Student Interns from the School of Theology have been serving as assistant ministers, Christian Education Directors, and Youth Ministers in local parishes for decades. Between twenty-five and thirty students serve in these parishes for fifteen to twenty hours a week during their second year at the School.

The Applied Professional Experience (APEX) program in the Goldman School of Graduate Dentistry began in 1989. All students in the school are placed in a community dental office as dental assistants. Students are paid a modest fee by the dental office, for which they work 40 hours a week.

Franciscan Children's Hospital Volunteers from the Community Service Center work at the hospital with infants and children who have multiple handicaps. Opportunities for service include infant care, working in the clinic, or assisting teachers in the hospital's classrooms.

The Veterans' Hospital is visited each week during the academic year by midshipmen in the Naval ROTC who spend a few hours with the long-term residents. The students, many of whom bring gifts of cookies or reading material, often form lasting relationships with the residents.

Army ROTC Scabbard and Blade is a program through which cadets participate annually in community service programs such as visiting the **New England Shelter for Homeless Veterans** and helping to build low-income housing.

Habitat for Humanity, an international non-profit volunteer organization, has enabled many students from Boston University since 1970 to participate in the construction of housing for low income families who would otherwise not be able to afford a house. Boston University students recently did the carpentry, painting, and other work that allowed six low-income homes in Dorchester to be completed.

Youth Camps Volunteers can work in one of the many summer camps throughout the Boston area serving urban children ranging in age from 6 to 14. Daily activities include sports, arts and crafts, tutoring, and field trips. This program is organized through the Community Service Center.

D. Funding and In-Kind Donations

The Boston Youth Campaign - Making Connections, summer youth program, and **Safe Neighborhood Plan** have been supported by the University through a summer sports program that offers 100 youths between the ages of 10 and 13 a program of recreational activities. The program objectives are to help these youths build social, interpersonal, and leadership skills. The Jackson Mann Community School Youth Center (for Allston and Brighton) and the Thomas Gardner School in Allston receive University funding.

Events sponsored by the Office of Government and Community Affairs have included the Roxbury Boys and Girls Club Shoot-Out, the Boston Boy Scouts Council, and Boston YMCA Benefit Basketball.

The Muddy River Project in Brookline received over $20,000 from Boston University in donated laboratory space, equipment, and faculty and graduate student help in assessing the physical, biological, and chemical quality of the river. This is part of a plan by the Town of Brookline to improve the water quality of the river. As a result of this assessment, a $500,000 grant was awarded to Brookline by the Corps of Engineers for the river's clean-up.

Holiday Parties are organized annually by the Office of Government and Community Affairs, as well as students, faculty, and staff of the University at locations such as the Thomas Gardner School in Brighton, the Lynch Recreation Center in Brookline, and youth and senior centers in Chelsea. Similar parties are organized each year by University fraternities and sororities.

Furniture donations from Boston University to non-profit organizations are made each year. Since 1984, furniture in reusable condition has been given to organizations including the Massachusetts Half Way House, the New Perspective School, area churches, recreation centers, and the Boston school and fire departments.

Training, Inc. is a training program for unemployed and underemployed men and women. Boston University works with this organization to train individuals for office jobs.
Boston University personnel managers have attended many job fairs, offering presentations about employment opportunities and workshops in interviewing skills.

Services to Individuals and the Community at Large

A. Scholarship Assistance

The University annually provides hundreds of scholarships to residents of the greater Boston community. In 1992, over 350 scholarships worth more than $4.8 million were awarded to Boston public high school graduates, Boston city employees, Boston public school teachers, Boston parochial school graduates, graduates of Bunker Hill and Roxbury Community Colleges, and families of fire fighters killed in the line of duty. The cumulative value of such scholarships since 1981 has been over $33 million. In addition, the University provides scholarships to residents of Chelsea and Brookline.

B. Community and Government Affairs

The Office of Government and Community Affairs, the primary University administrative group linking the University with the community recognizes that Boston University has an impact on its neighbors, and works to ensure that this impact is positive. The Office maintains frequent contact with area residents and state and local leaders, keeping them informed about development plans, evolving programs, cultural events, lectures, workshops, and seminars offered to the community. Two full-time professional staff members work directly with state and city government officials. The Director of State Relations represents the University's interests before the Legislature, Board of Regents, and executive branches of state government. The Director of City Relations maintains contact with the Mayor's office, the City Council, and city agencies.

Community Affairs A Director of Community Relations and a Community Relations Liaison maintain personal contact and communication between the University and its neighbors, working closely with residents and officials in Boston and Brookline. They respond to inquiries, organize efforts to meet community needs, and work closely with local business associations.

The Ride-Along Program Responding to neighborhood concerns about student parties, the Director of Community Relations "rides along" with the Boston Police on designated weekends. Students are encouraged to register events with the University, are given guidelines for the conduct of parties and, if necessary, are disciplined for unacceptable behavior.

Community Task Force Since 1984, the University and local representatives have used the Boston University Community Task Force as a forum to discuss community issues. University administrators, planners, and consultants also meet regularly with representatives of neighboring community organizations.

Master Plan Boston University, in cooperation with Community Task Force representatives and city agencies, was the first institution in the area to develop a Master Plan approved by the Boston Redevelopment Authority. The 10-year plan for the Charles River Campus analyzes both the University's needs (housing, enrollment, parking, academic and recreation) and potential sites for development.

Project Advisory Committee As an extension of the master planning process, the City and University organized a Project Advisory Committee to review a Planned Development Area Master Plan for the Commonwealth Armory site. Representatives from neighboring communities serve on this committee.

University Associates Cooperation Agreement is a comprehensive agreement which was negotiated and signed in 1991 by the administration of the Boston University Medical Center and members of its surrounding community. The document provides for a number of activities including employment training and education opportunities, a contribution to neighborhood green space, child care, and the creation of a not-for-profit inter-institutional transportation management association (ITMA). In addition, a Director of Community Services was hired by the Medical Center. This individual is responsible for the design and implementation of a community services program which is representative of the Medical Center's mission and responds to the community's need for improved health care.

C. Health Care Services

The Boston University Medical Center in the South End of Boston includes the School of Medicine, School of Public Health, the Goldman School of Graduate Dentistry, and Boston University Medical Center Hospital. The BUMC Hospital and Boston City Hospital, located directly adjacent to the Medical Center complex, are the principal teaching affiliates of Boston University School of Medicine. This rich concentration of medical educators, researchers, and health care professionals represents a major resource for many Boston communities that receive direct services. They are major deliverers of primary care for residents of the South End, South Boston, Roxbury, and Dorchester. The Boston University Medical Center Hospital provides free care to patients unable to pay. Many projects run by the Medical Center are described below, but there are dozens of other contributions to health care delivery, preventive medicine, and education carried out by individuals at the Center. The Sargent College of Allied Health Professions on the Charles River Campus also offers a wide variety of health care services to the community.

Health Care Affiliates There are twenty-two New England hospital and health-care agencies affiliated with the Boston University School of Medicine. Boston University Medical Center Hospital, Boston City Hospital and the Boston Veterans' Administration Medical Center are the School's principal affiliates in addition to many community hospitals. Students and faculty from the School of Medicine treat thousands of patients in these facilities annually.

Boston City Hospital's clinical staff is comprised almost exclusively of School of Medicine faculty members and physicians in training. This hospital is the only source of medical care for many of Boston's residents, particularly those from inner-city neighborhoods.

The Boston University School of Public Health offers the only evening program for a public health degree in Massachusetts. Many public health research projects conducted at the School contribute directly to the community's well being.

Boston Emergency Medical Center, comprised of Boston University Medical Center Hospital and Boston City Hospital is the busiest of Boston's three Level One trauma centers. The School of Medicine plays a key role in training emergency medical personnel in the treatment of trauma victims.

The Solomon Carter Fuller Mental Health Center, a state facility located at the Medical Center complex, is a mental health center offering screening, inpatient and outpatient care, the Children's Special Unit, the Gero Mental Health Program, the Roxbury Court Clinic, and the Libre Drug Clinic.

The Home Medical Service, sponsored jointly by the School of Medicine and the Boston University Medical Center Hospital, is the oldest continuously operating home medical program in the United States. Home Medical provides an array of health services for Boston elderly, delivering medical care to patients in their own homes. The Service makes approximately 5,000 home visits to 800 elders each year, thus enabling many patients who would otherwise require placement in nursing homes to remain independent. No patient is ever denied service for lack of ability to pay.

Elders Living At Home Program serves low to moderate income elders, age 60 or older, who are homeless or face the loss of their apartments, or who live in a life-threatening situation. The program provides clients with temporary shelter leased from the Boston

Housing Authority while permanent housing is located. ELAHP also provides or arranges for social services, health services, and legal counsel. This program also coordinates nursing and social work staffing and the Cardinal Medeiros Center, a nutrition site that serves some 150 homeless people daily.

The Boston Area Health Care Center provides academic support, mentoring, and paid internships to inner city youth during seven-week summer programs. In 1992, approximately 300 students graduated from this program.

Vaccines and Screenings Through the Boston University Medical Center, free vaccinations and health screenings are provided to the community. These include annual influenza vaccinations and screenings for skin cancer as well as for prostate cancer, glaucoma, and osteoporosis.

The Arthritis Center Center staff is active in a number of community efforts for arthritis patients in the inner city of Boston, including providing professional staff for the weekly Arthritis Clinic at Boston City Hospital, at the Evans Medical Clinic of Boston University Medical Center Hospital, and developing an arthritis outreach program for nursing home residents.

The **Cancer Research Center** sponsors educational programs and its staff carries out patient-care activities at the Boston University Medical Center Hospital, Boston City Hospital, Boston V.A. Medical Center, and other hospitals affiliated with the School of Medicine.

Geriatric Evaluation Center is a consultation program which provides comprehensive interdisciplinary team assessments of individuals 65 years of age or older. The center is dedicated to identifying problems which reduce the independence of older people and to making practical recommendations to enable individuals to function to their fullest capacity.

Silicone Gel Breast Implant Assessment Free evaluations by a plastic surgeon and a breast oncologist are provided to women who have concerns about the medical implications of silicone gel breast implants. Monitoring of implants and coordinating of medical care are also provided as necessary.

The Sargent Clinic at Boston University is a multi-service clinic in audiology, occupational therapy, physical therapy, and speech-language pathology, with vocational rehabilitation services and a fitness center. Speciality programs include: a Foot and Ankle Clinic, Postural Screening services with a state-funded program to train school health personnel in early detection of such disorders as scoliosis and lordosis; WordMoves, a program for preschool children with language/motor problems; plus seminars and workshops.

Biotechnology Education Several educational training programs are offered to the community including a Teacher Training Program, a minority High School Student Research Apprentice Program, a Biomedical Careers Program, and CityLab. Since 1990, 60 high school science teachers have participated in biotechnology training, 20 students and 4 teachers have assisted in the High School Research Apprentice Program, and 28 Boston residents have completed the 28-week training program in Biomedical Careers. Another 75 students and 30 teachers have participated in the CityLab program.

Nurse-Midwifery Education Program was established in response to the decreasing supply of obstetrical providers and the concomitant rise in infant mortality. The goal of the program is to increase the supply and ultimately the retention of community-oriented primary care nurse-midwives.

Massachusetts Elderly Diabetes Education Program (MEDEP) The School of Public Health, in conjunction with the Massachusetts Department of Public Health, the Office of Elder Affairs, the Boston Commission on Affairs of the Elderly, and The Joslin Diabetes Center, conducts a series of health education and training initiatives to increase diabetes-related symptom recognition, help-seeking, and follow-up care among elders. The program targets 750 low-income elders with information, screening programs, and follow-up medical care for complications.

Intervention and Stimulation for Exceptional Children (ISEC) Under the direction of the Department of Psychiatry, the Medical Center operates two programs for multiple-handicapped individuals. One is a day program approved by the Department of Education for children up to the age of 22 who live in Boston; the second is a day program that provides services to adults (age 22 and older) who are referred by the state Department of Mental Retardation.

Join Together The School of Public Health was selected to participate in this national organization for communities fighting substance abuse. As a member, the School will assist community groups to develop and strengthen skills needed to achieve a major reduction in substance abuse.

The Mom's Project is a community-based substance abuse eradication program designed to help drug- or alcohol-addicted African-American and Hispanic women of the inner-city end their dependence and to assist them in reducing their risk of contracting AIDS. Since the program began in 1989, more than 700 women have been helped.

Domestic Violence Education This program, currently under development, will help physicians identify signs of domestic violence and assist the victims.

The Failure to Thrive Clinic at Boston City Hospital has been at work since 1984 to identify and treat children who are not growing at a normal rate due to malnutrition. Most of these problems are due to poverty and resulting family stress.

Severe Pediatric Under-Nutrition Surveillance System monitors all children under the age of six seen in the hospital's emergency room. Once a child is identified as malnourished, the Clinic offers nutritional counseling to the family and works to get them support monies and nutritional supplements. The Clinic operates a clothing- and food-donation program as well. Between seventy and eighty percent of the more than 300 children treated annually are able to build up to normal weight within a year.

Medical Care Services Information is provided by the Boston University Medical Center Hospital to Boston residents on a toll-free telephone number staffed Monday through Friday, 9 a.m. to 5 p.m. General information about hospital services and a quick reference guide to choosing a physician are offered. The phone number is 1-800-842-3648.

Hypertension avoidance training is offered by members of the University's Cardiovascular Institute through programs aimed at preventing and treating heart disease. Sessions offered within the local community include training members of the Boston Police

Department to monitor one another's blood pressure and lessons in exercise and weight control.

Matters of Health is a column on health issues, furnished free of charge to twenty-three eastern Massachusetts daily and weekly newspapers for more than ten years. The column is prepared by the Medical Center's Office of Publication Services with the cooperation of faculty and staff.

The AIDS Support and Advocacy Group, an organization run by the Community Service Center, works with the AIDS Action Committee, the Children's AIDS Program, and Boston City Hospital to provide basic non-medical services for persons with AIDS who are homebound, or for those who serve as AIDS-awareness advocates or educators. Many volunteers work with children with AIDS.

"AIDS Services in the Boston Area Latino Community" is a resource guide prepared by researchers from the Boston University School of Public Health and Latino Health Network members. It was published in 1989 for distribution to social service agencies in the Latino community.

HIV-AIDS and Substance Abuse Education The School of Public Health offers a six-week certificate program in HIV-AIDS and Substance Abuse Education. The program is designed to address the shortage of public health personnel particularly among African-American and Hispanic populations. The School offers both financial and child care assistance to students.

The Massachusetts Chapter of the Committee to Combat Huntington's Disease has its headquarters at the Medical Center. Medical Center faculty and staff regularly raise funds for the Chapter.

The Parkinson's Disease Program, with headquarters at the Medical Center since 1979, runs an information and referral center that responds to over 3,000 telephone inquiries every year.

The **Danielsen Institute** provides discounted, direct mental health therapy services to individuals, couples, groups, families, and special focus groups in the Greater Boston area.

The Resource and Referral Center for Alzheimer's Diseases and Related Disorders, located at the Medical Center, provides information about the disease and and how to obtain help and treatment. The Center answers more than 1,200 requests for information annually. Physicians at the Center are engaged in research on new medications to treat Alzheimer's and related diseases.

D. Dental Care Services

The Goldman School of Graduate Dentistry was founded in 1963. Consistent with its philosophy of community outreach and "clinical training with the highest regard for human services," the School has instituted programs to serve many who often go without dental care. The School works in close cooperation with the Home Medical Service, the Boston University Medical Center Hospital, and the Neighborhood Health Centers to provide preventive intervention and referral services to underserved populations.

The Applied Professional Experience (APEX) program in the Goldman School began in 1989. All students in the school are placed in a community dental office as dental assistants. Students are paid a modest fee by the dental office, for which they work 40 hours a week.

Free dental screenings have been offered by the Dental School since 1981. On selected Open House Days, new patients can receive an initial dental exam, X-rays, and oral health screening. More than 300 Boston residents took advantage of this program last year.

Geriatric Dental Health Programs are provided to more than 900 elders annually by doctors from the Goldman School through the Home Medical Service and through visitations to four nursing homes, the Spaulding Rehabilitation Hospital and the Jewish Memorial Hospital.

Dental Health Plans for basic preventive care and dental services have been offered to Boston area public school students since 1985. Today, seventeen schools participate in a program offering their students biannual examinations and care on a prepaid plan at much lower cost than regular dental health plans.

A **Special Needs Dental Program**, run by the Dental School, sends doctors and students to more than 600 sites throughout Massachusetts to provide basic dental care to children and adults with disabilities. More than 5,800 patients are seen yearly in early intervention programs, Chapter 766 school programs, adult day programs and workshops, and community residential programs.

Day Care Centers in Boston, including two StrideRite centers and the South End Day Care Program and shelters for battered women, bring children between the ages of two and five to the dental school for treatment. Nearly 100 children are seen weekly, and patients are given a 50-percent discount.

Mass Migrant, a social agency for poor children in Lawrence, New Bedford, and Fall River, brings groups of children to the dental school for treatment, cleaning, and basic care. This program has brought free dental care to between seventy-five and one hundred children annually since 1980.

Dental Health Centers Through the School of Graduate Dentistry, Boston University provides quality dental care in state-of-the-art clinics at reasonable rates to all residents of Greater Boston.

E. Athletics/Fitness

Intercollegiate Athletics Varsity events are open to the public and tickets are regularly donated to underprivileged children and to civic groups such as YMCAs and community centers.

Athletic and Recreational Facilities are available for local high school use and for Special Olympics programs. Students from the School of Education sponsor weekly programs at the Case Physical Education Center for more than 350 elementary and junior high school students. Free ice time is provided for youth hockey programs, and the indoor track at the Commonwealth Armory is made available to public schools. In 1992, the University provided over $154,000 in donated use of its athletic and recreational facilities.

Special Olympics The University hosts the Massachusetts Special Olympics and the Suffolk Special Olympics each year. Faculty, staff, and students volunteer their time to support programs in which disabled people participate in weekly sports training and annual competitions.

Sargent Camp, a year-round recreational facility in New Hampshire, serves a wide constituency under a guiding ethic that aims to foster stewardship for the environment and a sense of teamwork. Each year, more than 3,000 school children participate in environmental education programs. In addition, numerous corporations, colleges and universities participate in adventure-based team-building programs. The camp is also a meals site for the Senior Nutrition Program three days a week.

F. Adult Education Programs

Prison Education Program. This program provides credit courses and degrees to inmates at the MCI-Norfolk prison facility. The University subsidizes tuition and faculty salaries. Since 1977, more than 100 bachelors' and 20 master's degrees have been granted. The recidivism rate for graduates of this program is extremely low.

The Intergenerational Literacy Project in Chelsea encourages language and literacy development in families who speak languages other than English. Both children and parents attend classes that place emphasis on valuing their cultural heritage while teaching them reading, writing, and speaking skills in English. The program, which is part of the Boston University/Chelsea Partnership, began in 1989.

The Literacy Program, one of the many volunteer programs run by the Community Service Center, works with several literacy agencies in the greater Boston area. Boston University students serve as tutors in English as a second language, adult basic education, and help individuals seeking a General Equivalency Diploma.

The Jackson Mann Community School Adult Education Program is run by Champions, a community service group in the College of Communication. Student volunteers work at the school tutoring, adult immigrants who are illiterate in English.

G. Programs for Professionals

The Small Business Development Program has helped over 800 potential entrepreneurs decide whether to start a business and write business proposals. Management professionals also provide support and help in finding financial backing.

The **Center for Energy and Environmental Studies** offers publications designed to deliver information to the community regarding the interrelationships between energy and the environment, emphasizing the significance of scientific research in policy-making.

The **Manufacturing Roundtable** teams faculty investigators with operating executives from a variety of industries, conducts conferences, seminars and symposia, and develops new courses, curricula, and teaching materials to advance manufacturing excellence through applied research.

The **Health Policy Institute** The Institute's Center for Industry and Health Care conducts workshops and conferences for corporate health-care managers, health professionals, health economists and health-institution leaders, and works closely with the corporate sector to promote employee health and productivity and to contain spiraling corporate health-benefit costs.

Workshops and continuing education courses in the health professions are offered regularly by faculty of the Sargent College of Allied Health Professions. An average of 15 programs are held annually, most of which are free or require only a $5 registration fee. Courses of interest to health practitioners cover subjects such as substance abuse, AIDS, and legal issues in research with human subjects. Many workshops report on current research being conducted by members of the Sargent faculty.

H. Programs for the Elderly

Evergreen Program Boston University sponsors this year-round program that, for a nominal fee of $10-$25, provides senior citizens with courses, lectures, and activities covering such subjects as politics, foreign languages, literature and music. A new series of lectures is offered every two months. Between 150 to 250 elders from the Greater Boston area attend each series. In addition, through the Evergreen program senior citizens are permitted to audit all regular University courses, whenever space is available, for a fee of $20.

The Gerontology Center conducts research and promotes education on aging. Courses are offered to practitioners and other interested persons on such subjects as: caregiver stress, healthy aging, drug interactions, and national health insurance. Some academic courses are available under the Evergreen Program.

I. Programs for People with Disabilities

The **N. Neal Pike Institute for the Handicapped**'s attorneys and law students work with professionals in the Aging Project at the Eunice Kennedy Shriver Center in Waltham, serving people who are both elderly and mentally retarded. The Institute also broadcasts a bi-weekly program, Disability Law News and Commentary, on the Massachusetts Radio Reading Network for individuals who are blind.

The **Center for Law and Health Sciences** provides legal consulting services for advocates serving people with mental and physical disabilities, conducts conferences and workshops on assorted health-related issues, and places law students in internships in the community.

Helping Hands is a research and service project affiliated with Boston University that trains Capuchin monkeys to serve as helpers to people who are paralyzed from the neck down. Between eight and ten Boston University undergraduates work for fifteen hours a week for two to four years as animal trainers, teaching monkeys to feed snacks and drinks, load and unload cassettes, and bring items to the person they will help. The monkeys also provide companionship and entertainment.

The Statewide Recreation Network, started in 1981 by the Department of Special Education in the School of Education, promotes creative recreational opportunities that can be enjoyed by people with and without disabilities. The network circulates information about resources and activities in Massachusetts and carries out specific projects to help individuals with disabilities.

Special Education Week has been sponsored annually since 1984 by the Department of Special Education in the School of Education. Workshops, lectures, and special meetings bring current methodologies to the public and professionals free of charge.

The Boston Marathon Wheelchair Division Racers are given assistance with their equipment and with the logistics of the race by students in the School of Education Special Education program and by other volunteers from the University.

J. Mentoring and Counseling

The Partners in Learning program pairs African-American students from the Lewis Middle School in Roxbury with African-American students from Boston University who give a few hours a week to act as their mentors. Fifteen to twenty such pairs have been brought together since 1989. They participate in recreational activities together and often do volunteer work in the Roxbury community.

The Siblings Program, run by the Community Service Center, links students at the University with children in the Winship Elementary School in Brighton The older students provide role models, companionship, and friendship to the younger children. Approximately 40 Boston University students volunteer each year for this program.

Horizons Volunteers work with children at shelters throughout the Boston area. Children range in age from 2 to 14. Volunteers attend an extensive training session to help them understand and serve the special developmental needs of children in shelters. The program is run through the Community Service Center.

The Veterans' Hospital is visited each week during the academic year by midshipmen in the Naval ROTC. Since 1987, students have spent a few hours each week visiting with long-term residents in the hospital. The students, many of whom take gifts as cookies or reading material, often form lasting relationships with the residents.

K. Religious Education and Ministry

The Elderly Ministry Project under the auspices of the Marsh Chapel at Boston University, teaches lay members of the Chapel congregation to minister to elders in local nursing homes. Begun in 1989, the project has trained ten lay ministers to counsel, conduct lay worship, and carry out lay preaching for those who are unable to attend churches.

The African-American Church Project is a cooperative program between members of Marsh Chapel and local African-American clergy. This cooperative group offers worship on campus in the African-American tradition, bringing in local pastors with their congregations and choirs. Members of the Boston University community then visit these congregations as well. The Project also organizes conferences and seminars in African-American worship.

The Howard Thurman Project at MCI-Norfolk and MCI-Framingham began in 1988. The Howard Thurman Center at Boston University donates video equipment, and videos and publications that carry the spiritual message of Howard Thurman, an outstanding preacher and leader in the African-American community. Similar materials are sent to the Hillside Pre-release Center in Roxbury and the McGrath Pre-release Center in Boston.

Weekend retreats at Sargent Camp are run annually by the Howard Thurman Center. Twenty students of differing ethnic backgrounds from West Roxbury High School go through a series of tasks and exercises designed to encourage recognition of their common humanity.

L. Legal Assistance

The Boston University School of Law has been a pioneer in the development of clinical legal education as a complement to the more theoretical perspective gained in the classroom. Each year, approximately 120 students participate in a variety of clinical programs under the close supervision of full-time experienced faculty. Hundreds of Boston area residents are thus offered free legal counsel at a highly professional level.

Criminal Law Clinics, open to third-year law students, have served the Boston area for more than twenty-five years. Students are responsible for the defense in nearly 350 criminal cases each year in the Boston Municipal Court and the Cambridge District Court, representing indigents who would otherwise require a court-appointed attorney. Students in the Prosecution Program represent the Norfolk County District Attorney's Office in cases in the Quincy District Court, prosecuting more than 180 cases annually. All cases are closely supervised by faculty members, who are practicing attorneys.

The Legal Aid Clinical Program enables law students to assist indigent clients in Boston. Through the Greater Boston Legal Services and the Walter E. Fernald State School for the Mentally Retarded, students are assigned cases concerning housing, welfare and social security benefits, consumer protection, divorce and child custody, employment, special education, and other matters.

The Arbitration and Mediation Clinic involves students in the mediation of small claims in a local district court, including conflicts among families, neighbors, landlords and tenants, and consumers and merchants. Some students serve as arbitrators with the American Arbitration Association in cases brought under the "Lemon Law."

The Legislative Services Program involves law students in the drafting of legislation and other projects for legislators, public interest groups, and government entities. Students assist in the formulation and execution of legislative solutions to problems. Approximately forty students have been involved in this program since 1975.

The Aging Project at the Eunice Kennedy Shriver Center Clinic allows faculty members and five students each semester to participate in the evaluation and planning teams for the elderly and mentally retarded individuals at the Shriver Center in Waltham. Students and faculty serve as legal representatives for clients.

M. Charities/Community Action

The Community Service Center is a student directed organization which sponsors more than 450 students who volunteer each year to help in programs dealing with illiteracy, the homeless, the elderly, and the disabled. Many of their programs are described in this section.

The Hunger Action Committee of the Community Service Center addresses local, national, and global hunger through education, fundraising, and direct services. Two major events include the OXFAM Fast and the Boston Hunger Clean-up. During the Fast, more than 1,000 students fast and the dollars saved are donated to OXFAM -- more than $5,000 a year has been raised since 1986. In the Hunger Clean-up, students raise money through business and individual donations while they clean city sidewalks. The Community Service Center raised $1,275 in 1992.

The Student Food Rescue Program, run by the Community Service Center since 1988, provides about 4,000 pounds of food every week to needy Boston residents. Some 40 student volunteers travel to area restaurants, bakeries, and supermarkets to collect food and distribute it to area meal programs including those run by Boston City Hospital, senior citizen homes, and the Boston Family Shelter.

The Mortarboard Society, a national senior honor society, has had twenty to twenty-five members at Boston University since 1975. Each year, members work once a month at the Church of All Nations Sunday's Bread soup kitchen. Members also work with the Boston Partners in Education - STARS program, offering tutoring at local schools and reading to child patients at Boston City Hospital.

United Way In addition to serving on advisory boards and volunteering to many United Way Agencies, the employees of Boston University generously support the United Way of Massachusetts Bay. In the 1992 campaign, faculty and staff contributed more than $168,000 to the United Way.

City-Year Servathon Students, alumni, and staff of the School of Management Public Management Program participated in the 1992 City-Year Servathon, the primary grassroots fundraiser for Boston's urban peace corps. The group raised over $5,000 through pledges of sponsorship for one day of service at the Berkley Street Community Gardens, joining other community volunteers to clean the gardens, prepare walking paths, and winterize the garden. The funds raised will be used to support one City-Year core member's post-service college scholarship.

Recycling Program Run by the Community Service Center, this program organizes and promotes the conservation of natural resources by collecting and recycling office paper and newspaper at established on-campus collection sites. In addition, a task force has been formed to identify ways to incorporate a recycling program in the residences and dining facilities of the University.

The Young at Heart Program Sponsored by the Community Service Center, this program pairs elders with students who assist with errands and provide companionship.

The Boston Can Share drive for donations of canned goods is supported annually by a major drive at Boston University Medical Center Hospital. The donated goods are distributed through the Boston Food Bank to more than 200 food pantries.

An Annual Huntington's Hoop-a-thon, sponsored by the MA/Huntington's Disease Society and the Boston University Medical Center, has been held since 1979 to raise funds for a summer camp for Huntington's patients.

U-Help is an annual fund drive conducted among Boston University Medical Center Hospital employees to provide special funds for patients with emergency needs. Often the funds are used to assist the patient's family with expenses or compensation for lost pay while they stay with a sick relative.

Run-to-Save-a-Child is an annual fundraising road race organized by the Naval ROTC at Boston University. Since 1986, twenty to thirty students have raised in excess of $5,000 each year, which is donated to the Shriner's Burn Clinic.

An "M & M-a-Thon" has run annually since 1986, organized by members of the Sigma Delta Tau sorority. A competition to eat M&M's attracts pledges, and the money raised is donated to the National Committee for the Prevention of Child Abuse.

Air Force ROTC Community Awareness consists of several community service projects in which cadets participate every year. These include the Boston Food Bank, The City-Year Servathon, and Veterans Awareness Week.

Self-Help Groups are given space and support by Marsh Chapel throughout the year. Several twelve-step programs, including Overeaters Anonymous, Al-Anon, and Alcoholics Anonymous hold weekly meetings at the Chapel.

N. Cultural and Intellectual Programs

Boston University is a center of cultural and intellectual activity. On average, there are 250 lectures, performances, and other events each week during the academic year, emanating from the fifteen different schools and colleges of the University. These events include exhibits in the arts, worship services, recreational events, lectures, workshops, conferences, social events, and performances. Most of these events are offered free of charge or for a nominal fee and are open to the public. The following listing illustrates the variety of activities available to the community.

The Boston University Mugar Library Boston University welcomes members of the community to utilize its main research library. With almost 5 million volumes and volume equivalents, and thousands of journals, Mugar Library complements school and community libraries of the cities surrounding the University.

Special Collections contains the University's rare book, archival, and manuscript collections. Among its holdings are the Boston Symphony Orchestra Archive, the History of Nursing Archive, the Abraham Lincoln and Theodore Roosevelt Collections, the Mystery Writers of America Library, the Robert Frost Collection, and the Twentieth Century Archives, a collection of personal papers from more than 1,600 American and European figures prominent in 20th century public life and the arts. The department is open to the public and regularly sponsors exhibits of its collections.

B.U. Bookstore Mall The Charlesbank Bookshop, a component of the Bookstore Mall, holds numerous authors' readings and book-signings throughout the year. Through its Saturday Children's Hour program, which includes storytelling, puppet shows, and craft projects, the world of literature is made accessible to the young and the young-at-heart.

Boston University School of Visual Arts Students and faculty of the the School of Visual Arts are major participants in the community of artists in the Boston area. Members of the faculty contribute their work regularly to area shows, and student work is displayed in end-of-the year exhibits each year at the Boston University Art Gallery. These shows are open to the public free of charge.

Saturday Art Classes have been offered by the School of Visual Arts to Boston area high school students since 1974. Each semester twenty-five talented juniors and seniors are accepted into this intensive drawing class. No tuition is required and admission is based on interest and the submission of a basic portfolio.

Boston University Art Gallery Numerous free exhibitions are held each year and are open to the public. Exhibitions include some of the finest contemporary art and craftsmanship to be displayed in the Boston area. In addition, **The George Sherman Union Gallery** displays the work of many new, local artists.

The School of Music at Boston University is one of the few university-based conservatory quality schools of music in the country. Students and faculty at the school perform in more than 400 musical events throughout the year, all of which are open to the public and are most often free of charge. The Boston University Orchestra has long been hailed by critics, and the Empire Brass Quintet and Muir String Quartet are both Naumburg award winners. ALEA III, a contemporary music ensemble, and two performing collegiums in Early Music and Contemporary Music also perform regularly. The University Chorus produces four major choral concerts each year, and the highly acclaimed Opera Department stages two full productions annually, as well as shorter offerings. Special performances for schools, nursing homes, and other events are frequently arranged throughout the school year.

Lecture Series Each year, the University offers a variety of lectures open to the public, many free of charge. Lectures are given by University faculty and distinguished visitors and cover a wide variety of topics ranging from religion to environmental issues.

The String Training and Educational Program (Project STEP) for minority students is partially sponsored by Boston University, which originally initiated the program with the Boston Symphony Orchestra in 1982. STEP identifies six- and seven-year-olds with talent and interest in music and offers them weekly lessons with master teachers and intensive coaching and encouragement. Between twenty-five and thirty students are enrolled each year in the program, many of them from the FOCUS program that identifies minority first-graders who have musical talent. Several faculty members from the School of Music teach in the STEP and FOCUS programs.

Greater Boston Youth Symphony Orchestra Talented music students, ages 12 to 18, from the communities surrounding the University are invited to participate in this program. In 1992, 240 youths received training and performance experience. The Orchestra has performed at sites across the nation, including Symphony Hall in Boston and the White House.

The Boston University Tanglewood Institute was started in 1965 to give high school students many of the educational and musical opportunities enjoyed by older musicians at the Tanglewood Music Center in Lenox, Massachusetts, the summer home of the Boston Symphony Orchestra. Young musicians study for one to two months under dedicated, professional teachers. Proximity to the Boston Symphony Orchestra makes this a superb opportunity for immersion into the world of professional music by young students.

Boston University School of Theatre Arts The University's nationally recognized School of Theatre Arts stages several public productions each year.

Huntington Theatre Company The University is a major sponsor of this non-profit professional theater company that performs at the University's theatre on Huntington Avenue. Six productions are presented each year to audiences of more than 100,000. The theater also offers several community service programs, including the Student Matinee Series, the Young Critics Institute, and the Huntington Speakers Bureau.

The Humanities Forum at the Huntington Theatre invites noted scholars to write essays for each of the season's productions. More than 7,000 copies of these essays are distributed to audiences and interested readers. The scholars also hold open forums after two Sunday matinee productions of the plays, presenting a brief lecture on each play and opening the session to discussion. The Forum has been running free of charge since 1986, and more than 250 theatre-enthusiasts attend the lectures for each play.

Student Matinee Series are offered by the Huntington Theatre Company enabling 1,200 students to attend each play of the season. Students purchase tickets for $5. Prior to the production the Education Director of the company visits each school and lectures on the background, author, and significance of the play. A new Teachers' Advisory Council of fifteen area high school teachers is working with the Education Director to develop study guides for the discussion of the next series of plays.

Radio Station WBUR 90.0 FM This University-owned and supported radio station broadcasts national and local news, lectures, sports events, classical music, jazz, folk and popular music, arts and entertainment commentaries, and radio dramas to Greater Boston, eastern Massachusetts, and parts of Rhode Island and New Hampshire. The station is qualified by the Corporation for Public Broadcasting and is an affiliate of National Public Radio and American Public Radio. In 1990 WBUR won five Associated Press Awards for news coverage in Massachusetts, more than any other Massachusetts radio station.

Neighborhood Network News Boston University provides studio facilities for the Neighborhood Network News (Boston Cable Access Television) which provides access and service to approximately 200 local organizations and agencies. In addition, the station provides reports on educational systems, politics, and community services to its viewers.

Judson Boardman Coit Memorial Observatory Each week the Astronomy Department opens the University observatory to the public free of charge. Many lectures and presentations are sponsored in conjunction with this program including live telecasts of NASA's historic Voyager 2 flight to Neptune. In 1992, more than 1,800 visitors came to the Observatory.

Appendix B Regulatory Approvals - MEPA Certificate

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street, Boston, 02202

WILLIAM F. WELD
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ARGEO PAUL CELLUCCI
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June 23, 1994

CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS ON THE ENVIRONMENTAL NOTIFICATION FORM

PROJECT NAME : Boston University Center for Photonics Research
PROJECT LOCATION : 22 Babbitt Street - Boston
EOEA NUMBER : 9976
PROJECT PROPONENT : Boston University
DATE NOTICED IN MONITOR : May 24, 1994

Pursuant to the Massachusetts Environmental Policy Act (G. L., c. 30, s. 61-62H) and Sections 11.04 and 11.06 of the MEPA regulations (301 CMR 11.00), I hereby determine that the above project does not require the preparation of an Environmental Impact Report (EIR).

The proposed project consists of the demolition of an existing engineering building and a vacant industrial building of about 46,000 square feet (sf) and the construction of a nine story 250,000 sf building. The proposed building will include lab space, classroom/lecture and seminar rooms, and supporting library facilities. In addition, an adjacent existing science and engineering building of about 49,000 sf at 110-112 Cummington Street will be rehabilitated and connected to the proposed new building. The project site contains about 1.06 acres and is located between Cummington Street, St. Mary's Street and the Massachusetts Turnpike. Water consumption for this project is estimated to increase by 14,660 gallons per day (gpd) and wastewater generation is projected at 6,410 gpd.

Given the square footage of the proposed building and its uses, and based on the Institute of Traffic Engineers Trip Generation Manual, the proponent has estimated that the building will generate 1,890 net new trips. However, the proponent has presented additional information that the project will generate no increase in the student population and about 105 new employees

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to the campus. Considering the mode split for the Boston University campus, only 81 new employees are projected to drive to work, which will generate about 217 new vehicle trip ends. No new parking facilities are proposed as part of this project. Parking demand from this project will be accommodated by the proponent's existing parking facilities where there is sufficient capacity to handle this increase.

According to the proponent, the proposed project will require an Industrial Sewer Use Discharge Permit from the Massachusetts Water Resources Authority (MWRA). A Construction Permit will be required from the Massachusetts Turnpike Authority. The proposed project is subject to review by the Boston Redevelopment Authority (BRA) under Article 31 of the Boston Zoning Code. Accordingly, the proponent must prepare a Project Impact Report (PIR).

Although I believe there are outstanding issues that warrant further clarification or analysis, these issues are not within the subject matter of the state permits needed for this project (with the possible exception of air quality issues raised in the comment from the Department of Environmental Protection). Having reviewed the Scoping Determination issued by the BRA for this project, I find that requiring an EIR, in addition to the PIR, would not be likely to add to the scope or depth of the analysis, nor to the resolution of the outstanding issues.

I note that the proponent intends to update its Charles River Campus Master Plan and that the BRA's Scoping Determination calls for a clarification in the PIR of how the project fits into this Master Plan and/or the changes that the project will necessitate. I recommend that the proponent move forward with this update expeditiously as it is needed to fully address some of the campus-wide issues, such as transportation and parking, and associated impacts on the environment. I also recommend that the proponent include the following intersections in Brookline to its level of service (LOS) analysis: St. Mary's Street/Mountfort Street and Carlton Street/Mountfort Street/Lenox Street. The proponent should furthermore address how traffic and related air quality impacts can be reduced through transportation demand management (TDM) measures, such as providing a subsidy to monthly transit pass employees, preferential parking for carpoolers and vanpoolers, and improvements to bicycle facilities. With respect to proposed mitigation of impacts, the proponent should provide a specific implementation schedule and identify the parties responsible for funding and implementation.

I request that the proponent and the BRA take these comments, as well as the ones attached to this Certificate, into consideration when preparing and reviewing the PIR. I also request that a copy of the PIR be provided to the MEPA Unit to be included with the file.

June 23, 1994
DATE

Jan Reitman, Asst. Secretary
Trudy Coxe, Secretary

Comments received : BRA, 5/31/94
BWSC, 6/6/94
DEP/NERO, 6/6/94
Brookline Transportation Dept., 6/7/94
Boston University Task Force, 6/8/94
Kenmore Residents Group, 6/8/94
MWRA, 6/9/94
Kenmore Community & Economic Development Corp., 6/9/94
The Bay State Road Neighborhood Assoc., 6/9/94
Kenmore Assoc., 6/10/94
Jackson Mann Community Center, 6/10/94
Brighton Board of Trade, 6/10/94
Allston Civic Association, 6/10/94
Audubon Circle Neighborhood Assoc., 6/10/94
Fort Point Assoc., 6/13/94
BRA, 6/22/94
Earth Works Action, undated

TC/WTG/wg

Appendix C Draft Chemical Safety Guidelines

PHOTONICS

DRAFT GUIDELINES ON CHEMICAL SAFETY

CHEMICAL SAFETY GUIDELINES

A. GENERAL REMARKS

It is the policy of PHOTONICS that all chemicals be handled properly. Fires, explosions, air contamination and chemical burns can be prevented this way. Work processes can present hazards. Chemical splashes may cause immediate danger to the skin and eyes. Inhalation of some chemicals may result in a delayed or cumulative effect. Most chemicals have identifying labels which include applicable precautionary measures. Transport of chemicals through buildings must be done using approved containers. Rubber gloves, aprons and goggles must be worn when handling corrosive chemicals. Chemical reactions emitting toxic vapors must be properly vented with an appropriate local exhaust system (laboratory hoods.) Toxic and flammable liquids are to be manipulated in a hood. Flammable liquids and solvents will cause fire and possibly explosion if the vapors contact hot surfaces, open-type wiring or ordinary electrical equipment.

Storage of flammable solvents must be kept to a minimum. Plastic equipment must not be used with flammable solvents in amounts larger than one liter. Plastic containers are not permitted in the solvent storage area. Refrigerators and cabinets with "approved for flammable storage" labels must be used for the storage of flammable materials. All chemicals must be stored in approved closed containers and properly labeled.

It is the policy of the company that employees using or handling chemicals be especially vigilant of their daily hygiene in order to prevent skin dermatitis. Frequent use of soap and water will prevent most dermatitis for those exposed to chemicals and oils. Good personal hygiene, good personal work habits and good housekeeping are the three most important protective barriers against chemical hazards.

B. CHEMICAL SAFETY PROGRAM

In order to effectively transmit information concerning chemical hazards in the laboratories to employees, contractors, and interested parties, PHOTONICS is committed to the following program:

1. A list of all hazardous chemicals present in each laboratory will be maintained and updated by PHOTONICS. This list will be periodically reviewed for accuracy by a member of the technical staff in

each laboratory.

2. A Material Safety Data Sheet for each substance on the list will be on file. Any employee, contractor, or interested party with a question about a substance is entitled to a copy of its MSDS and all other information regarding this substance.

3. The manufacturer's label on a container of a hazardous substance will not be removed or defaced. If an empty bottle now contains another substance, the old label will be obliterated and replaced with a new label. The new label will contain the identity of the hazardous chemical(s) and the appropriate hazard warnings.

4. PHOTONICS will offer training to every employee. This training will include:

   a. The physical and health hazards of the chemicals in the laboratory.

   b. The methods and observations that may be used to detect the presence or release of a hazardous chemical. These include the visual appearance and odor of the substance and possible monitoring devices.

   c. The selection and correct use of personal protective equipment including instructions in the safe handling of the substance.
   d. The procedures to be followed in the event of a spill or any other emergency.

   e. The details of the Hazard Communication Program, an explanation of the labeling system, and the location of the MSDS.

5. Hazard Communication and Chemical Safety Training

   PHOTONICS has developed an OSHA Compliance Program for Chemical Hygiene in the Laboratory and Hazard Communication Act. The program as described in the Hazard Communication manual consists of:

   a. A List of all chemicals present in each laboratory will be maintained by a member of the laboratory will periodically review the accuracy of the list.

b. Material safety data sheets for each chemical substance in the various laboratories will be on file in the library area.

c. Information on label requirements and a prohibition on removing or defacing labels on bottles containing original chemical materials. If an empty bottle is to be reused with a new substance labels must be replaced accordingly.

d. Specific training literature which describes Employer and Employee rights and responsibilities, educational programs, a section by section description of material safety data sheets, and labels.

e. Specific toxicological information which will enable them to understand the hazard warning statements, effects of chemicals and the various hygienic standards.

f. Health and Safety considerations in handling chemicals in the workplace e.g. physical and physiological classifications, basic personnel protective practices. Chemical storage and spill considerations.

C. BASIC CHEMICAL HANDLING PROCEDURES

Carefully read the label before using a chemical. The Material Safety Data Sheet (MSDS) will provide any special handling information.

1. Do not work alone in the laboratory.

2.Use required personal protective equipment.

3. Label all containers with appropriate hazard information.

4. Keep your hands and face clean. Wash thoroughly with soap and water after handling any chemical.

5.Avoid direct contact with any chemical.

6.Keep chemicals off your hands, face and clothing, including shoes.

7. Never smell, inhale or taste a hazardous chemical.

8. Smoking, drinking, eating and the application of cosmetics is forbidden in areas where hazardous chemicals are in use.

9. Do not dispense more of a chemical than is needed for immediate use.

10. Always use chemicals with adequate ventilation or in a chemical fume hood, as appropriate. Refer to the MSDS.

11. Use hazardous chemicals only as directed and for their intended purpose.

12. Inspect equipment or apparatus for damage before adding any chemical. Do not use damaged equipment.

13. Never use mouth suction to fill a pipette. Use a pipette bulb or other pipette aid.

14. Electrically ground and bond containers using approved methods before transferring or dispensing a flammable liquid from a large container.

15. For specific information regarding chemical handling, contact your supervisor or the Safety Committee.

   a. Do not store chemicals in alphabetical order.

   b. Separate hazardous chemicals in storage as follows:

      * Solids: oxidizers, flammable solids, water reactive, others

      * Liquids: acids, caustics, oxidizers, perchloric acid, flammable/combustibles

      * Gases: toxic, flammable, oxidizers and inert.

   c. Once separated into hazard classes, chemicals may be stored alphabetically.

   d. Do not store incompatible chemicals in close proximity to each other.

   e. Use approved storage containers and safety cans for flammable liquids.

   f. Use spill trays under containers of strong acidic or basic reagents.

g. Write the date received and the date opened on each chemical.

h. Dispose of old chemicals promptly and properly.

i. Do not store liquids above eye level.

j. Label all containers properly.

For more information on chemical storage, contact your supervisor.Certain hazardous chemicals cannot be safely mixed or stored with other chemicals because a severe reaction can take place or an extremely toxic reaction product can result. The label and MSDS will contain information on incompatibilities.The label and MSDS will indicate any special hazards involving a given solvent. Solvents can be volatile, harmful when inhaled, absorbed through the skin, and flammable. Flammable liquids are more hazardous at elevated temperatures due to more rapid vaporization. Electrically ground and bond containers using approved methods before transferring or dispensing a flammable liquid from a large container or drum. Transfer only the amount necessary for immediate use. Use approved flammable liquid containers and storage cabinets. Keep flammable liquids from heat source. Do not store flammable liquids near oxidizing agents (e.g. chromic acid, permanganates, chlorates or perchlorates). Avoid skin contact and inhalation of solvents. Do not dispose of solvents down sinks or drains. Use only with adequate ventilation or in a fume hood. Use assigned personal protective equipment.

D. MATERIAL SAFETY DATA SHEETS (MSDSs)

A Material Safety Data Sheet (MSDS) is a document containing chemical hazard and safe handling information and is prepared in accordance with the OSHA Hazard Communication Standard. Chemical manufacturers and distributors must provide the purchasers of hazardous chemicals an appropriate MSDS for each hazardous chemical purchased. If an MSDS was not provided with the shipment of a hazardous chemical, the company will request one in writing from the manufacturer or distributor. The company maintains MSDSs on file and attempts to make sure that the information is current. Upon request the company will make MSDSs available to employees. If you wish to review an MSDS, contact your supervisor or call Personnel Office.

MSDSs DESCRIPTION BY SECTION

Section I of the MSDS lists information identifying the manufacturer and the product.

*manufacturer's name, address and telephone number
*number to call in case of emergency
*chemical name and synonyms
*trade name and synonyms
*chemical family and formula
*CAS# (Chemical Abstract Service) for pure materials

If your work requires an understanding of this chemical information, contact your supervisor.

Section II describes the various hazardous ingredients contained in the product, the percentages, and exposure limits when appropriate.

*pigments, catalysts, vehicle, solvents, additives, others
*base metal, alloys, metallic coatings, fillers
*hazardous mixtures of other liquids, solids or gases
*CAS# of components

All hazardous chemicals which comprise 1% or greater of the mixture will be identified.

Carcinogens will be listed if the concentrations are 0.1% or greater.

Section III describes the physical characteristics of the material.

*boiling point
*specific gravity
*vapor pressure
*percent volatile
*vapor density
*evaporation rate
*solubility in water
*appearance and odor

Section IV describes the fire and explosion hazard data for the material. Based on the flash point and other fire and explosion data, the appropriate extinguishing agent for fires involving the material will be listed.

Special procedures may also be listed.

*flash point
*upper and lower explosive limits (UEL/LEL)
*extinguishing agent - water, dry chemical, foam, halon, etc.*special fire fighting procedures
*unusual fire and explosion hazards, toxic fumes

Section V describes the known health hazard data for the material and exposure limits. Symptoms or the health effects of an overexposure are listed. This information will help the user and medical personnel recognize an overexposure has occurred.

*threshold limit value
*effects of overexposure: headache, nausea, narcosis, irritation, weakness, etc.
*primary routes of exposure: inhalation, skin, ingestion
*cancer or other special health hazards
*emergency and first aid procedures: ingestion, inhalation, skin contact, eye contact.

Section VI describes reactivity data; that is, the material's ability to react and release energy or heat under certain conditions or when it comes in contact with certain substances.

*stability: stable, unstable, conditions to avoid
*incompatibility: materials to avoid
*hazardous decomposition products
*hazardous polymerizations: conditions to avoid

Section VII gives instructions for the steps to be taken in case of an accidental release or spill. The steps normally include information on containment, evacuation procedures and waste disposal as appropriate. The statements on the MSDS are general; more specific information is available from your supervisor or instructor.

*steps to be taken in case material is released or spilled
*waste disposal methods

Section VIII describes the protective equipment for the individual who might have to work with the substance. This section normally describes worst case conditions; therefore, the extent to which personal protective equipment is required is task dependent. Contact your supervisor or instructor for instructions.

*respiratory equipment: dust mask, chemical cartridge respirator, self contained breathing apparatus.
*ventilation: local, general, special
*protective gloves: type
*eye protection
*other protective equipment

Section IX describes handling and storage procedures to be taken with the material. Information may include statements such as keep container closed; store in a cool, dry, well ventilated area; keep refrigerated; avoid exposure to sunlight; etc.

Section X describes any special precautions or miscellaneous information regarding the material. In some cases, manufacturers may choose to withhold certain information on a MSDS provided the information is trade secret. However, the MSDS must still contain all relevant hazard, protection and health information. Some MSDSs may not contain all ten sections or the information may be in a slightly different order. However, the basic information described above must be provided. Some MSDSs are more complete than others. Do not assume everything you need to know is contained on the MSDS.If you have any questions ask your supervisor.

E. EMPLOYEE RIGHTS AND RESPONSIBILITIES

Employees who may be exposed to hazardous chemicals are guaranteed access to the following:

*Chemical exposure information
*Workplace Chemical Lists
*Material Safety Data Sheets

In addition, employees will receive training on the hazards of chemicals and on the measures they can take to protect themselves. The employer will provide appropriate personnel protective equipment and instruction in using this equipment. You have the right to file a complaint against the company regarding alleged violations of the Hazardous Chemical Information Act. If you file a complaint, the act protects you from:

*discharge
*cause for discharge
*discipline
*discrimination
*loss of pay, position, seniority or benefits

Alleged violations of the standard should be referred to your supervisor or the safety committee. However, you always have the right to file a complaint with the

Commonwealth of Massachusetts and/or with OSHA. Providing you with information does not affect the liability of the company with regard to the health and safety of employees. The company still has the responsibility to take action to prevent the occurrence of occupational disease and unnecessary exposure. Remember, you are responsible for following safety policies and procedures for which you have received training. This responsibility is to your employer and, more importantly, to yourself. So it is important for you to understand the safety aspects of your job.

F. EMPLOYER RIGHTS AND RESPONSIBILITIES

Employers have the right to take disciplinary action against employees who do not follow established safety policies and procedures. Employers ought further to consider the employee safety record of management/ supervisory personnel when making decision about salary and promotion. Employers have both the right and responsibility to protect workers with unique susceptabilities by placing them in alternative positions of employment. There are four considerations for exercise of this kind of placement decision.

1. Decisions are for protection and placement only, and not for job hiring or firing.

2. Alternative job placement for personal protection does not adversely alter personal income.

3. Alternative job placement for uniquely susceptible workers is not seen as an alternative to prudent health and safety practice. Generally dangerous practices, such as exposures to toxic substances above recommended thresholds, should be met by engineering rather than personnel manipulations.

4. Civil rights may not be abused.

Even within these considerations, employers may wish to protect the health and well-being of some employees in certain types of jobs by finding alternative jobs. In turn, employers are responsible for providing training and information that permit employees to work safely. Minimum requirements are listed in this document. It is the right and responsibility of the employer to require that both supervisory and supervised personnel must comply with the internal safety policies.

G. EDUCATIONAL PROGRAMS

The company provides at least annually, an education and training program for employees using or handling chemicals. Additional instruction is provided whenever the potential for exposure to hazardous chemicals is altered or whenever new information concerning a chemical is received. New or newly assigned employees are provided training before working with or in a work area containing hazardous chemicals. Training program includes the following:

*interpreting labels and MSDS
*location of hazardous chemicals
*acute and chronic effects of chemicals
*safe handling procedures
*personal protective equipment
*first aid
*clean up procedures
*waste disposal

In the event a large variety of hazardous chemicals are stored or in use, the company substitutes generic training for chemical specific training. The contents of this pamphlet meet, in part, the generic training requirements. Your supervisor will provide additional training as necessary. The company is required to keep a record of training sessions provided to employees. You may be requested to sign an attendance sheet verifying your attendance at a training session.

H. CHEMICAL WASTE DISPOSAL PROCEDURES

Chemical disposal is an issue for the chemist and those handling the waste. Selection of a disposal method depends on the nature of the compound as well as the quantity to be disposed of. Prompt disposal of waste materials helps to reduce: fire hazards, unnecessary exposure of personnel to toxic vapors and disagreeable odors. The following disposal methods are intended as a guide in the disposal of small quantities of waste chemicals. Careful consideration of the physical and chemical properties of any substance must be made before disposal. For disposal of large quantities of waste chemicals, contact the facility manager for instructions.

1.Definitions

a. Hazardous waste - Includes most liquid chemical waste and some solid waste. Examples include: waste solvents, waste inks, waste chemicals used in printing, and mixtures of water and trichloroethane.

b. Waste safety can - An approved container: of not more than five gallons capacity having a spring closing lid and a spout cover, designed to safely relieve internal pressure when subjected to external heat. These cans are available with nonmetallic and provide high resistance to corrosion, dents and punctures.

c. Manifest - A record or log of the specific identity and quantity of hazardous waste in each safety can.

2. Waste Disposal Guidelines

Flammable and combustible hazardous waste must be placed in a safety can. If the waste is nonflammable and not corrosive, it may be placed in a temporary plastic container. If the waste is corrosive, it may be placed in a temporary glass container. This waste must later be transferred to a D.O.T. container. Plastic or glass waste containers must be placed in boxes before being transported. Temporary waste containers must be labeled properly (organic solvent waste, chromic acid waste). A manifest of the identity and quantity of all hazardous waste must be kept. When a waste safety can is approximately 3/4 full and the manifest is complete and correct, dispose of the waste into a properly labeled and approved D.O.T. 55-gallon waste drum.

3. Hazardous Waste Precautions

a. Do not dispose of any hazardous waste in the sink.

b. Do not dispose of glass or plastic gallon chemical containers containing hazardous waste residue. Dispose of residue in the waste safety can. Rinse containers with water or appropriate solvent and empty diluted contents into a waste safety can.

c. Make sure containers are thoroughly cleaned and the original labels removed before disposing of containers in a dumpster.

d. Contact the Safety and Health Director regarding questions or uncertainties concerning disposal of hazardous waste.

4.Safety and Health Requirements

a. When transferring flammable material from waste cans to 55-gallon drums, make sure the drum must be grounded and the waste safety can bonded.

b. The 55-gallon drum must be opened slowly to relieve any internal pressure.

c. A face shield, gloves and organic respirator must be worn while disposing of any waste.

5. Reactions of Hazardous Waste

Waste safety cans and 55-gallon drum waste containers must be labeled with the category of waste. For example, a container with organic waste solvents should be labeled "organic solvents." The addition of an incompatible waste, which may result in fire, explosion or release of flammable gases, must be avoided.

6. Chemical Hazards

A chemical compound is generally regarded as toxic if it can cause any disturbance of normal physiology. Absorption of toxic materials can occur by inhalation, by ingestion, or by skin contact. Concentrations as low as one part per million in the atmosphere can be inhaled and have caused significant harm. Materials inhaled through the nose and mouth can be partially dissolved in saliva and enter the stomach. Inhalation can be controlled by proper ventilation and the use of respirators. Skin contact is a very common route of exposure. It can be avoided by: developing clean methods of handling materials, keeping the hands off the rest of the body during the handling period and by washing the hands promptly after the handling period is completed. Do not depend on rubber gloves as complete protection against chemicals. Tongs or special tools may be more practical for handling objects submerged in liquids. All chemicals, unless proven otherwise, must be regarded as potential hazardous and handled accordingly. Some of the more common chemical hazards are discussed below. Proceed with caution when handling new chemicals. Seek all the information available on toxicity studies. Ask your supervisor about the chemicals you are using.

I. DISPOSAL OF CHEMICALS

Disposing properly laboratory wastes and unused chemicals is a very complicated matter due to the number and diversity of the chemicals found in the laboratories. In general follow these guidelines:

1. Do not throw anything down the drain unless you are certain it is allowed by government regulation.

2. Limit the quantity of waste, where possible, by substituting non hazardous substance for hazardous ones or by scaling down the size of the experiment.

3. Only order the quantity of a substance necessary, especially for chemicals which have a limited shelf-life, and where possible, try to find another researcher willing to use a half-full bottle rather than throwing it away.

4. Inactivate hazardous components or reclaim spent solvents, where practicable.

J. DISPOSAL BY SEWER

The Massachusetts Water Resources Authority regulates what is not allowed in the sewer. Specifically prohibited are:

1. Flammable or explosive liquids. These chemicals have a flash point less than 100oF (37.8°C).

2. Solids or viscous substances which have the potential to obstruct the flow sewers.

3. Liquids or vapors hotter than 150oF (65oC).

4. Fats, wax, grease or oils which may modify or become viscous between 32oF (0oC) and 150oF (65oC).

5. Toxic metal ions in concentration greater than 1 ppm.

6. Any toxic non metals with an LD50 less than 50 mg/kg.

7. Liquids with a Ph outside 5.5 and 9.5. However, if these liquids are neutralized to a Ph between 5.5 and 9.5 and they are not prohibited for other reasons, they may be flushed down the drain. **ALWAYS FLUSH WITH EXCESS WATER.**

K. DISPOSAL OF HAZARDOUS WASTE

Wastes not allowed in the sewer will be disposed of as hazardous waste. The procedure is:

1. Place the waste in a glass one gallon (4 liter) bottle.

2. Non reactive wastes may be mixed.

3. Separate chlorinated and non-chlorinated.

4. Attach a red DANGER tag identifying the major constituents.

5. Carry full bottles to the hazardous waste storage area and place on the shelf or in the cabinet.

6. Log in the waste on the Chemical Waste Packing List. Hazardous solids and sludges or other non liquid wastes, including contaminated materials and materials used to clean spills, should be placed in gallon wide mouth plastic jars or durable plastic bags. Attach a red DANGER tag identifying the approximate quantity of hazardous material and place in the designated container in the hazardous waste room and log in the material on the Chemical Waste Packing List.

L. CHEMICAL INACTIVATION AND RECLAMATION

As reports of improperly dumped wastes and contaminated ground water increase in frequency it has become evident that disposal of chemical wastes by hazardous waste is the least attractive alternative. Procedures detailing other methods are available for some wastes. Small amounts of some hazardous substance can be inactivated by chemical means. This, generally, involves adding the substances to a large excess of bleach or some other common material. For specific procedures, contact the Chemical Hygiene Officer (CHO). Wastes which contain primarily one material may be able to be purified and reused. This, generally involves distilling the waste and analyzing the result for purity.

LIST OF CHEMICALS (BIOLOGY LABORATORY)

CHEMICAL	*AMOUNT*
2′-Deoxycytidine	*100 mg*
2-hydroxy ethyl-mercaptan	*100 ml*
2 propanol	*6 x 1 L*
Acetic acid	*4.5 gallon*
Acridine orange	*10 g*
Acrylamide	*2 kg*
Agarose	*1 kg*
Amethopterin (methotrexate)	*3 x 10 mg*
Ammonium Acetate	*500 g*
Ammonium Acetate	*500 g*
Ammonium Chloride	*500 g*
Ammonium Persulfate	*3 x 10 g*
Ammonium Sulfate	*100 g*
Barium Hydroxide	*1 lb*
Beric acid	*2.5 kg*
Biogel P-60	*100 g*
Biogel	*100 g*
Bleach (5.25% sodium hypochlorite)	*2 gallon*
Blue dextran	*5 g*
Boric Acid	*1 kg*
Bovine albumen	*10 g*
Bromphenyl Blue	*5 g*
BRUD (5′-Bromodeoxyuridine)	*5 mg*
Buffer solution PH 4	*500 ml*
Buffer solution PH 9	*500 ml*

Buffer solution PH 7	500 ml
Calcium chloride	5 ml
Casein	2 x 100 g
Chelex-100	100 g
Chloroform	6 x 500 ml
Chromomycin A3	3 x 1 mg
Citric acid	500 g
Citric acid	5 lbs
Colcemid (10mg/ml)	2 x 10 ml
Colcemid	2 x 10 mg
Collagenaze	2 x 100 mg
DAPI 4’6-diamidino-2-phenylindole	2 x 1 mg
Deoxy nucleotides	400 mg
Dextran Sulfate	2 x 500 g
Dextrose	1/4 lb
Dimethylsulfoxide (DMSO)	15 ml
Distamycin A	2 mg
DNA (E. coli)	10 mg
EDTA	1 kg
EDTA-disodium	1 kg
Enzymes (assorted)	1 g
Ethidium Bromide	5 g
Ethidium Bromide	1 g * 3
Ethyl alcohol	3.5 gallon
Fetal calf serum	500 ml
Ficoll	100 g
Ficoll	100 g

Polysucrose	35 g
Sodium diatrizoate	50 g
Formamide	6 x 500 ml
FUDR (5-fluorodeoxyuridine)	100 mg
Gelatin	250 g
Gelatin	500 g
Giemsa Stain	7 x 100 ml
Glacial acetic acid	1 gallon
Glycerin	1 L
Glycerin	1 L
HBSS (saline)	1 L
Heparin	5,000,000 units
Heparin	100,000 units
Hepes	250 g
Histopaque	6 x 100 ml
Hoechst 33258	2 x 1 g
Hydrochloric acid	1 gallon
Hydrochloric acid	500 ml
iso amyl alcohol	500 ml
Isopropyl alcohol	10 L
Magnesium chloride	500 g
Magnesium chloride	500 g
Magnesium chloride	500 g
Magnesium sulfate	5 lbs
Maleic acid	100 g
Methyl alcohol	2.5 gallon
Methyl green	2 x 5 g

N-Lauroyl sarcosine	*500 g*
Methylene bisacrylamide	*100 g*
Nonidet P-40	*500 g*
Paraformaldehyde	*500 g*
Pepsin	*5 g*
Perma Wash	*2 x 10 quart*
Phenol	*6 x 500 g*
Phenol	*100 g*
Phosphate buffered saline	*30 gallon*
Phosphate Buffer Saline Tabs	*50 g*
Photo-Activator	*4 x 2.5 gallon*
Photo-Fixer	*10 x 35 fl. oz.*
Photo-Flo	*3 x 16 fl. oz.*
Photo-Stabilizer	*4 x 2.5 gallon*
Photo-Stop bath	*1.25 x 16 fl. oz.*
Polyethylene glycol	*1 kg*
Potassium chloride	*500 g*
Potassium chloride	*1 kg*
Potassium dichromate	*500 g*
Potassium Phosphate dibasic	*1 lb*
Potassium Phosphate monobasic	*2 lbs*
Protease	*1 g*
Quinacrine mustard	*100 mg * 3*
Rad-Con	*12 18 oz cans*
SDS	*2 x 500 g*
Silver Nitrate	*1/4 lb*
Sodium Acetate	*3 kg*

Sodium Azide	100 g
Sodium Bicarbonate	1000 g
Sodium Chloride	3 kg
Sodium Citrate	1 kg
Sodium Citrate	500 g
Sodium Citrate	2 lbs
Sodium Citrate (dibasic)	5 lbs
Sodium Citrate (monobasic)	4.5 lbs
Sodium Dodecyl Sulfate	500 g
Sodium Hydroxide	3 x 5 kg
Sodium Hydroxide	1/4 quart
Sodium Hypochlorite (bleach)	1 gallon
Sodium Phosphate (dibasic)	3 kg
Sodium Phosphate (monobasic)	1 kg
Sodium Pyrophosphate	500 g
Spermidine trihydrochloride	5 g
Sucrose	3 kg
Sucrose	3 kg
Sulphuric Acid	500 ml
Thymidine	1 g * 2
Triton x 100	3 x 500 ml
Trizma base	5 kg
Trizma Base	1 kg
Trizma HCI	1 kg
Tween 20	100 ml
Tween-20	5 g
Wescodyne	1 gallon

Wright's Stain	10 g * 2
Xylene Cyanol	100 g
Xylene	100 ml

MISCELLANEOUS - <1 gram per year

Crystal Violet Stain

Formaldehyde

Monoclonal Antibodies

NP40

Propidium Iodide

Rnase A

Tergitol

Trypan Blue Stain

Appendix D Transportation

BU Photonics Research Center
Trip Generation

I. *Research & Engineering Employees*

(Includes Faculty, Staff, Administrative, Graduate Students & Technicians)

Position	Total Future	Relocated	New	Mode Split Vehicle*	Mode Split Transit**	Mode Split Other***
Faculty/Research	91	23	68	80%	10%	10%
Admin/Staff	46	20	26	73%	15%	12%
Grad Students	316	316	0	73%	13%	14%
Total	453	359	94			

* Vehicle includes drive alone, carpool, and drop-offs
** Transit includes MBTA bus and subway
*** Other includes walking and bicycles

Total Future Trips

Time Period	Trip Rate			Total Trips				Mode Split		
	Fac/Res	Adm/Staff	Grad Stud	Fac/Res	Adm/Staff	Grad Stud	Total	Vehicle	Transit	Other
Daily*	3	3	4	273	138	1264	1675	1242	212	221
AM Peak Hour**	1.00	1.00	1.00	91	46	316	453	337	57	59
PM Peak Hour**	1.00	1.00	1.00	91	46	316	453	337	57	59

Total New Trips to Campus

Time Period	Trip Rate			Total Trips				Mode Split		
	Fac/Res	Adm/Staff	Grad Stud	Fac/Res	Adm/Staff	Grad Stud	Total	Vehicle	Transit	Other
Daily*	3	3	4	204	78	0	282	220	32	30
AM Peak Hour**	1.00	1.00	1.00	68	26	0	94	73	11	10
PM Peak Hour**	1.00	1.00	1.00	68	26	0	94	73	11	10

* Faculty, Research, Administrative and Staff daily trips = 1.5 times AM+PM peak hour trips
Graduate Student, Technician daily trips = 2 times AM+PM peak hour trips
** For worst case, all employees arrive in AM peak hour and leave in PM peak hour

Mode splits obtained from 1986 Campus Parking Plan Study

BU Photonics Research Center
Trip Generation

II. Students (Undergraduate)

	Classroom Capacity	Classroom Utilization	Classes per Day	Seats filled per day	Mode Split Vehicle	Mode Split Other
Future Seats	878	75%	6	3951	23%	77%
Existing Seats	425	50%	6	1275		
			Difference	2676		
Actual New Seats	453	75%	6	2039		
Equivalent New Seats	595	75%	6	2676		

** Existing seats are less utilized than future seats will be, so they can not be subtracted out 1 for 1.
Equivalent new seats factors in the difference in utilization.

Total Future Trips

Time Period	Trip Rate	Overlap djustmen	Adjusted Rate	Total Trips	Mode Split Vehicle 23%	Mode Split Other 77%
Daily*	9	0.5	4.5	3951	909	3042
AM Peak Hour**	0.75	1.00	0.75	659	151	507
PM Peak Hour***	1.50	1.00	1.5	1317	303	1014

Total New Trips to Site

Time Period	Trip Rate	Overlap djustmen	Adjusted Rate	Total Trips	Mode Split Vehicle 23%	Mode Split Other 77%
Daily*	9	0.5	4.5	2676	615	2061
AM Peak Hour**	0.75	1.00	0.75	446	103	343
PM Peak Hour***	1.50	1.00	1.5	892	205	687

* 6 classes at 75% capacity = 450% of total capacity = 4.5 times total seats times 2 trip ends per student = 9

** Classes in every room start during AM peak hour, so .75 of total seats = trips to site

*** Classes end and begin in every room during PM peak hour, so .75 of total seats = trips to and from site
For worst case, no student with an afternoon class also has an evening class in the building.

Mode splits obtained from 1986 Campus Parking Plan Study

III. Trip Distribution

Total New Vehicle Trips to Campus

Route to Photonics Center*	%	Number of Trips		
		Daily	AM Peak	PM Peak
BU Bridge	26%	57	19	19
Comm Ave east of site	34%	74	25	25
Comm Ave west of site	28%	63	21	21
Route 1	12%	26	8	8
Total	100%	220	73	73

* Routes estimated using origin zipcodes from 1986 faculty and staff surveys.

BU Photonics Research Center
Vehicle Origins by Zip Code

HOMEZIP	COUNT	Direction from Site	Route
1130	1	WEST	BU Bridge
1238	1	WEST	BU Bridge
1265	1	WEST	BU Bridge
1266	1	WEST	BU Bridge
1291	1	WEST	BU Bridge
1450	2	WEST	BU Bridge
1451	2	WEST	BU Bridge
1469	1	WEST	BU Bridge
1518	1	WEST	BU Bridge
1519	1	WEST	BU Bridge
1532	2	WEST	BU Bridge
1569	1	WEST	BU Bridge
1581	2	WEST	BU Bridge
1701	15	WEST	BU Bridge
1707	1	WEST	BU Bridge
1719	2	WEST	BU Bridge
1720	4	WEST	BU Bridge
1721	2	WEST	BU Bridge
1730	5	WEST	BU Bridge
1741	1	WEST	BU Bridge
1742	9	WEST	BU Bridge
1746	8	WEST	BU Bridge
1752	5	WEST	BU Bridge
1756	2	WEST	BU Bridge
1757	1	WEST	BU Bridge
1760	9	WEST	BU Bridge
1770	2	WEST	BU Bridge
1773	2	WEST	BU Bridge
1775	1	WEST	BU Bridge
1776	1	WEST	BU Bridge
1778	3	WEST	BU Bridge
1801	5	NORTH	Comm Ave west of site
1803	7	NORTH	Comm Ave west of site
1810	5	NORTH	Comm Ave west of site
1821	3	NORTH	Comm Ave west of site
1824	1	NORTH	Comm Ave west of site
1830	2	NORTH	Comm Ave west of site
1841	1	NORTH	Comm Ave east of site
1844	1	NORTH	Comm Ave east of site
1852	1	NORTH	Comm Ave east of site
1860	1	NORTH	Comm Ave east of site
1862	1	NORTH	Comm Ave east of site
1863	1	NORTH	Comm Ave east of site
1866	1	NORTH	Comm Ave east of site
1867	3	NORTH	Comm Ave east of site
1876	1	NORTH	Comm Ave east of site
1880	1	NORTH	Comm Ave east of site
1890	13	NORTH	Comm Ave east of site
1902	4	NORTH	Comm Ave east of site
1904	1	NORTH	Comm Ave east of site

Sum of COUNT		
Route	Total	%
BU Bridge	240	26%
Comm Ave east of site	308	34%
Comm Ave west of site	258	28%
Route 1	106	12%
Grand Total	912	100%

Sum of COUNT		
Direction from Site	Total	%
EAST	22	2%
NORTH	289	32%
SOUTH	242	27%
WEST	359	39%
Grand Total	912	100%

BU Photonics Research Center
Vehicle Origins by Zip Code

HOMEZIP	COUNT	Direction from Site	Route
1905	1	NORTH	Comm Ave east of site
1906	4	NORTH	Comm Ave east of site
1907	4	NORTH	Comm Ave east of site
1908	2	NORTH	Comm Ave east of site
1921	2	NORTH	Comm Ave east of site
1923	1	NORTH	Comm Ave east of site
1930	6	NORTH	Comm Ave east of site
1938	1	NORTH	Comm Ave east of site
1940	2	NORTH	Comm Ave east of site
1944	1	NORTH	Comm Ave east of site
1945	3	NORTH	Comm Ave east of site
1950	8	NORTH	Comm Ave east of site
1960	1	NORTH	Comm Ave east of site
1966	2	NORTH	Comm Ave east of site
1970	4	NORTH	Comm Ave east of site
1982	3	NORTH	Comm Ave east of site
2019	1	SOUTH	Comm Ave east of site
2021	5	SOUTH	Comm Ave east of site
2025	2	SOUTH	Comm Ave east of site
2026	8	SOUTH	Comm Ave east of site
2030	4	SOUTH	Comm Ave east of site
2035	1	SOUTH	Comm Ave east of site
2038	1	SOUTH	Comm Ave east of site
2042	1	SOUTH	Comm Ave east of site
2043	2	SOUTH	Comm Ave east of site
2045	1	SOUTH	Comm Ave east of site
2048	1	SOUTH	Comm Ave east of site
2052	3	SOUTH	Comm Ave east of site
2053	1	SOUTH	Comm Ave east of site
2054	1	SOUTH	Comm Ave east of site
2056	1	SOUTH	Comm Ave east of site
2061	2	SOUTH	Comm Ave east of site
2062	3	SOUTH	Comm Ave east of site
2066	3	SOUTH	Comm Ave east of site
2067	5	SOUTH	Comm Ave east of site
2069	1	SOUTH	Comm Ave east of site
2070	1	SOUTH	Comm Ave east of site
2072	3	SOUTH	Comm Ave east of site
2081	3	SOUTH	Comm Ave east of site
2090	4	SOUTH	Comm Ave east of site
2093	2	SOUTH	Comm Ave east of site
2107	1	EAST	Comm Ave east of site
2108	4	EAST	Comm Ave east of site
2110	1	EAST	Comm Ave east of site
2114	5	EAST	Comm Ave east of site
2115	8	EAST	Comm Ave east of site
2116	3	EAST	Comm Ave east of site
2118	3	SOUTH	Comm Ave east of site
2119	3	SOUTH	Comm Ave east of site
2120	2	SOUTH	Route 1

BU Photonics Research Center
Vehicle Origins by Zip Code

HOMEZIP	COUNT	Direction from Site	Route
2121	5	SOUTH	Comm Ave east of site
2122	2	SOUTH	Comm Ave east of site
2124	2	SOUTH	Comm Ave east of site
2125	6	SOUTH	Comm Ave east of site
2126	4	SOUTH	Comm Ave east of site
2128	3	NORTH	Comm Ave east of site
2129	1	NORTH	Comm Ave east of site
2130	22	SOUTH	Route 1
2131	16	SOUTH	Route 1
2132	6	SOUTH	Route 1
2134	8	WEST	Comm Ave west of site
2135	33	WEST	Comm Ave west of site
2136	7	SOUTH	Route 1
2138	23	NORTH	BU Bridge
2139	15	NORTH	BU Bridge
2140	9	NORTH	BU Bridge
2141	2	NORTH	BU Bridge
2143	4	NORTH	BU Bridge
2144	9	NORTH	BU Bridge
2145	2	NORTH	BU Bridge
2146	32	SOUTH	Route 1
2146	32	WEST	Comm Ave west of site
2148	10	NORTH	Comm Ave east of site
2149	4	NORTH	Comm Ave east of site
2150	3	NORTH	Comm Ave east of site
2151	3	NORTH	Comm Ave east of site
2152	3	NORTH	Comm Ave east of site
2154	10	WEST	Comm Ave west of site
2155	11	NORTH	Comm Ave east of site
2158	11	WEST	Comm Ave west of site
2159	26	WEST	Comm Ave west of site
2160	10	WEST	Comm Ave west of site
2161	12	WEST	Comm Ave west of site
2162	2	WEST	Comm Ave west of site
2164	1	WEST	Comm Ave west of site
2165	11	WEST	Comm Ave west of site
2166	8	WEST	Comm Ave west of site
2167	9	WEST	Comm Ave west of site
2168	7	WEST	BU Bridge
2169	4	SOUTH	Comm Ave east of site
2170	8	SOUTH	Comm Ave east of site
2171	5	SOUTH	Comm Ave east of site
2172	24	WEST	Comm Ave west of site
2173	17	NORTH	BU Bridge
2174	29	NORTH	BU Bridge
2176	6	NORTH	Comm Ave west of site
2178	16	NORTH	BU Bridge
2180	6	NORTH	Comm Ave east of site
2181	16	WEST	Route 1
2184	5	SOUTH	Comm Ave east of site

BU Photonics Research Center
Vehicle Origins by Zip Code

HOMEZIP	COUNT	Direction from Site	Route
2186	5	SOUTH	Comm Ave east of site
2187	1	SOUTH	Comm Ave east of site
2188	2	SOUTH	Comm Ave east of site
2189	3	SOUTH	Comm Ave east of site
2190	3	SOUTH	Comm Ave east of site
2191	1	SOUTH	Comm Ave east of site
2192	12	WEST	BU Bridge
2193	9	WEST	Comm Ave west of site
2194	4	WEST	BU Bridge
2195	1	WEST	BU Bridge
2215	23	WEST	Comm Ave west of site
2324	1	SOUTH	Comm Ave east of site
2332	4	SOUTH	Comm Ave east of site
2333	1	SOUTH	Comm Ave east of site
2343	2	SOUTH	Comm Ave east of site
2351	1	SOUTH	Comm Ave east of site
2356	1	SOUTH	Comm Ave east of site
2359	1	SOUTH	Comm Ave east of site
2368	5	SOUTH	Comm Ave east of site
2370	1	SOUTH	Comm Ave east of site
2375	1	SOUTH	Comm Ave east of site
2382	1	SOUTH	Comm Ave east of site
2401	4	SOUTH	Comm Ave east of site
2402	2	SOUTH	Comm Ave east of site
2416	1	SOUTH	Comm Ave east of site
2532	1	SOUTH	Comm Ave east of site
2571	3	SOUTH	Comm Ave east of site
2703	1	SOUTH	Route 1
2736	1	SOUTH	Route 1
2767	2	SOUTH	Route 1
2906	1	SOUTH	Route 1
3038	2	NORTH	Comm Ave east of site
3051	1	NORTH	Comm Ave east of site
3060	2	NORTH	Comm Ave east of site
3079	1	NORTH	Comm Ave east of site
3132	1	NORTH	Comm Ave east of site
3259	1	NORTH	Comm Ave east of site
3801	1	NORTH	Comm Ave east of site
3824	1	NORTH	Comm Ave east of site
3827	1	NORTH	Comm Ave east of site
3833	1	NORTH	Comm Ave east of site
3909	1	NORTH	Comm Ave east of site
4043	1	NORTH	Comm Ave east of site
4090	1	NORTH	Comm Ave east of site
Grand Tot	912		

BU Engineering Building
Existing 22 Babbitt Street Classroom Usage

Room: *B33*
Capacity: *186*

Time	Monday	Tuesday	Wednesday	Thursday	Friday		
8:00	57	66	57	66	57		
8:30	|	|	|	|	|		
9:00	55	|	55	|	55	Min	10%
9:30	|		|		|		
10:00	98	113		113		Max	61%
10:30	|	|		|			
11:00	|	|		|			
11:30	|	|		|			
12:00	38		38				
12:30	|	100	|	100			
1:00	|	|	|	|			
1:30	|	|	|	|			
2:00	104	80	53	80			
2:30	|	|	|	|			
3:00	|	|	|	|	20		
3:30	|	86	|	86	|		
4:00		|	19	|	|		
4:30		|	|	|	|		
5:00			|				
5:30			|				
6:00	66	54	66	54			
6:30	|	|	|	|			
7:00	|	|	|	|			
7:30	|	|	|	|		Maximum	Average
Total Daily Students	418	499	288	499	132	499	367
# of Classes	6	6	6	6	3	6	5
Average Class Size	70	83	48	83	44	83	66
Total Daily Usage	2.25	2.68	1.55	2.68	0.71	2.68	1.97
Average Room Usage	37%	45%	26%	45%	24%	45%	35%

AM peak hour - Students arrive for first class between 7:30 and 8:30 AM

Students	57	66	57	66	57	66	61
% of Capacity	31%	35%	31%	35%	31%	35%	33%

PM peak hour - Students leave afternoon & arrive for evening classes between 5:00 and 6:00 PM

Students	66	140	85	140	20	140	90
% of Capacity	35%	75%	46%	75%	11%	75%	48%

BU Engineering Building
Existing 22 Babbitt Street Classroom Usage

Room: ***150***
Capacity: ***120***

Time	Monday	Tuesday	Wednesday	Thursday	Friday		
8:00	22		22				
8:30	|		|				
9:00	|		|			Min	4%
9:30	|		|				
10:00	61	42	61	42		Max	87%
10:30	|	|	|	|	50		
11:00	|	|	|	|	|		
11:30	|	|	|	|	|		
12:00	50	85	50	85			
12:30	|	|	|	|			
1:00	|	|	|	|	5		
1:30	|	|	|	|	|		
2:00	102	85	102		20		
2:30	|	|	|		|		
3:00	|	|	|		|		
3:30	|		|		|		
4:00	104	37	104	37	20		
4:30	|	|	|	|	|		
5:00	|	|	|	|	|		
5:30	|	|	|	|	|		
6:00	46	48	46	48			
6:30	|	|	|	|			
7:00	|	|	|	|			
7:30	|	|	|	|		Maximum	Average
Total Daily Students	385	297	385	212	95	385	275
# of Classes	6	5	6	4	4	6	5
Average Class Size	64	59	64	53	24	64	53
Total Daily Usage	3.21	2.48	3.21	1.77	0.79	3.21	2.29
Average Room Usage	53%	50%	53%	44%	20%	53%	44%

AM peak hour - Students arrive for first class between 7:30 and 8:30 AM

Students	22	0	22	0	0	22	9
% of Capacity	18%	0%	18%	0%	0%	18%	7%

PM peak hour - Students leave afternoon & arrive for evening classes between 5:00 and 6:00 PM

Students	150	85	150	85	20	150	98
% of Capacity	125%	71%	125%	71%	17%	125%	82%

Appendix E Infrastructure - Demand, Correspondence

Bostongas

Boston Gas Company
201 Rivermoor Street
Boston, Massachusetts 02132
Telephone (617) 323-9210

CANNON
Attn: Kevin Barry
2170 White Haven Road
Grand Island, N.Y. 14072

August 4, 1994

Re: B.U. Center of Photonic Research

Dear Mr. Barry:

We have reviewed your correspondence and we are pleased to inform you that we will be able to provide sufficient gas for your needs at the specified location. As the system in this area is all low pressure, i.e. 4" water column, no P.R.V. is required. In fact, depending on the boiler requirements, a gas booster may be necessary and should be considered when laying out the boiler room.

Attached to this letter is a sales agreement which indicates a customer contribution of $19,608.00. This money will be applied to the cost incurred for relaying approximately 385' of gas main in Babbitt and Cummington Streets.

Please have this agreement signed and returned so that proper scheduling can be completed.

We look forward to working with you on this project and should questions arise, please feel free to call.

RECEIVED CANNON

AUG 10 1994

Proj. No.________________
File Category________________

Sincerely

John P. Roderick
Direct Sales Representative
Marketing

/ber

Attachment

BOSTON EDISON
800 Boylston Street
Boston, Massachusetts 02199

August 12, 1994

Theodore G. Fowler, PE
Vice President Engineering
Cannon
2170 Whitehaven Road
Grand Island, New York 14072

Dear Mr. Fowler:

Thank you for your July 15th letter to Boston Edison regarding the new Boston University Center for Photonic Research. You requested information on two items; service availability and energy conservation incentives.

Boston Edison is prepared to provide for all of the energy and energy service requirements of the Photonics Center. However, Demand Side Management Programs are presently fully subscribed. As the construction period draws closer, there is a slight possibility that funding may be available for high efficiency upgrades. I will keep you posted on the status of our Demand Side Management Programs.

I look forward to working with you on this and other projects.

Very truly yours,

Chris Tomasini
Account Executive
Sales Department

cc: Bill Costa, Boston University

Draft - Revised 8/12/94

Boston University
Center for Photonics Research

DPIR

Calculations

1. Fire Service Flow

(3) standpipes required for building coverage

per NFPA 14 = 500 + 250 + 250

= **1,000 gallons/minute**

2. Water Service Peak Flow

A. Domestic:

Estimated load by fixture

40 water closets at 10 FU each	=	400	
10 urinals at 5 FU each	=	50	
54 lavatories at 2 FU each	=	108	
218 sinks at 3 FU each	=	654	
11 drinking fountains at 1 FU each	=	11	
10 mop sinks at 3 FU each	=	30	
Total	=	1,253	FU
then maximum instantaneous demand	=	**240**	**gallons/minute**

B. Process

Cooling tower make up based on chiller capacity at 1830 tons and flow at 3 GPM/ton.

Per ASHRAE, 1992 edition, Chapter 37, to maintain concentrations at 2, allow:

- 0.1 percent of circulating flow for tower drift
- 0.8 percent of circulating flow for evaporation
- 0.9 perent of circulating flow for blow down

or Total of 1.8 percent

then peak tower make up

= 1,830 x 3 , 0.018 = **90 gallons/minute**

C. Maximum peak flow

peak flow = domestic + process load

= 240 + 98

= **33~~4~~8 gallons/minute maximum**

Memorandum **CANNON**

July 14, 1994

TO: Paul McGowan, Bob Peterson, Young Jo Sul

FROM: Ted Fowler

SUBJECT: Boston University - Center of Photonic Research
Cannon Project No. 988.00

The following comprises a list of electrical engineering responses to the BRA-DPIR scoping letter regarding infrastructure impact analysis for your disposition/use.

Electric Service and Distribution

- Response to comment Paragraph A

1. The proposed project is anticipated to have a connected electric load of approximately 5,871 KW with the following breakdown:

Load	KW
(2) 900 KW Chillers	1,080
(1) 150 hp Fire Pump	112
(5) 50 hp Elevators	187
Misc. Motor Loads	792
Lighting	418
General Building and Receptacle Loads	190
Laboratory Equipment/Receptacles	3,092
Connected Load Total	5,871

At an anticipated 90% power factor, this correlates to a transformer connected load of 5708 KVA. Note that the above loading does not include a required 650 KW allowance for anticipated backfeed to the 50,000 sq.ft. 110-112 Cummington Street Buildings and the 32,000 sq.ft. 704 Commonwealth Avenue Building.

2. The new service entrance switchgear will be a free standing module metal enclosed assembly indoor type, with overcurrent, under-voltage, and ground fault protective relays.

3. The Boston Edison Power Company will provide two (2) medium voltage 13.8 KV utility services from Babbitt Street, one preferred and one alternate, to the new medium voltage service entrance switchgear line up located in the basement level. Two double-ended unit substations will be provided for 480V general distribution throughout the building. This type of double-ended arrangement is intended as a means of reducing the required

GU-06

transformer capacity in a redundant system. When one feeder is lost, the remaining transformer, in the double ended substation arrangement, may be overloaded but can handle the load with the addition of forced air cooling, which increases the capacity of dry type transformers 33%. The fans are not intended to be utilized for a long period of time.

4. The estimated substation sizes are as follows:

   A. Basement Level - 2 at 2500 OA/3333FA KVA: 480 volts.

   B. Basement Level - 2 at 250 OA/3335FA KVA: 480 volts.

5. The secondary (600 volt) distribution system will be designed to respond to the power needs for this building along with the flexibility to accommodate future space/functional changes anticipated for this laboratory facility. The distribution voltage at each unit substation will be 480V, 3 phase, 4 wire plus ground. This will provide service to equipment and lighting loads. This voltage will be further transformed down to 208Y/120V, 3 phase, 4 wire for receptacles, miscellaneous equipment, etc.

- Response to comment, Paragraph B

1. The proposed project will be provided with the following energy conservation features:

   A. Variable frequency drive supply and return fans for each variable air volume HVAC system.

   B. Energy efficient chillers of .65 KW per ton full load performance vs. baseline of .73 KW per ton.

   C. Two speed cooling towers.

   D. Multi-stage constant volume pumps.

   E. High efficiency motors at 1750 rpm.

   F. Building automation system with energy management controller capable of performing all management functions necessary to reduce energy consumption.

   G. Energy efficient lighting.

F. High efficiency transformers.

H. Power factor correction capacitors.

- Response to comment, Paragraph C
(response by Kevin Barry)

- Response to comment, Paragraph D

1. The proposed project will be provided with a 1,000 KW diesel engine driven, water cooled engine - generator set located within the penthouse area with a dual fuel transfer pump set and a main tank located in the Basement Level. Please note that a 600 gallon main tank is necessary to provide 7 hours of operation capacity. Size of the main tanks will depend on finalized anticipated peak shaving techniques being considered and mechanical boiler system fuel requirements (shared tank possibility). A 150 gallon tank will be provided for additional fuel capacity at the generator set location and will be fitted with retention capability. The generator loading is estimated to be 900 KW serving emergency lighting, fire pump, one elevator in each elevator bank, sump pumps, atrium smoke exhaust systems, and fire protection alarm systems. A remote generator plan annunciator will be provided at the fire command center for system monitoring. The emergency generator system will also be used to allow a chiller to be put on the emergency power system for testing the generator under load, for peak shaving to reduce energy cost, and to allow this chiller to be available to be utilized to provide some cooling during prolonged outages. In an emergency power condition, peak shaving operations shall be terminated.

- Response to comment, Paragraph 3

1. Other systems analyses will be completed during the beginning phases of construction documents; however, it is known that a telecommunication backbone for Boston University telephone and computer networking systems are anticipated down Babbitt Street in an underground ductbank. Fiber optic media are anticipated within these underground ducts. Some of these fiber optic interconnects will include building automation system networking transmission for energy management from the Boston University Office of the Physical Plant.

/ht

cc: Kevin Barry

REFERENCES

1. Topographic Plan of Land, Harry R. Feldman, Inc., June 22, 1994 (REV.).

2. Water Distribution System Map (sheets 22G,23G,22H & 23H), Boston Water and Sewer Commission, 1986.

3. Wastewater System Map (sheets 22G,23G,22H & 23H), Boston Water and Sewer Commission, 1986.

4. Requirements for Site Plans, Boston Water and Sewer Commission.

5. Profile of Storm Drain & Sewer lines in Babbitt Street, DWG D-1349, City of Boston Public Works Department, 1919.

6. Record Plan-Metropolitan Sewer Boston and Brookline, Section B, MWRA, September 1891.

7. Reconstruction Part of Brookline Overflow from St. Mary's Street, South Metropolitan System, Metropolitan District Commission Sewerage Division, MWRA, August 1948.

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SANITARY SEWER

CALCULATIONS

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PROJECT Boston University - Center for Photonics Research
SUBJECT Avg. Daily Use for Buildings Outletting Sanitary to 10" SS in Babbitt St.

REF. PAGE

ADDRESS	AVG. DAILY USE BWSC* (FT^3/DAY)	FT^3/S	x 200%
704 Commonwealth Ave.	194	.002	.004
708 Commonwealth Ave.	134	.002	.004
710 Commonwealth Ave.	200	.002	.004
712 Commonwealth Ave.	44	.0005	.001
714 Commonwealth Ave.	68	.0008	.0016
718 Commonwealth Ave.	194	.002	.004
722-728 Commonwealth Ave.	2709	.035	.07
SUBTOTAL	3543 = 26502 GPD**		
110 Cummington St.	741 (5543 GPD)+	.01	.02

* Avg. daily use are averaged over one year, 7-93 thru 7-94. Avg's were calculated from actual meter readings obtained from BWSC Customer Service on 7-25-94.

** 26502 x 200% = 53004 GPD

+ 5543 x 200% = 11085 GPD

URS CONSULTANTS, INC.

PROJECT Boston University – Center for Photonics Research
SUBJECT Sample Calculations

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SAMPLE CALCULATION FOR DETERMING AVG. DAILY USE

ADDRESS ⇒ 704 COMMONWEALTH

READING #1 ⇒ 395160 FT^3 DATE: 3/1/94
READING #2 ⇒ 307240 FT^3 DATE: 12/3/92
DAYS BETWEEN READINGS ⇒ 453

FT^3 OF WATER USED ⇒ 87920 FT^3

$$\text{AVG DAILY USE} = \frac{FT^3 \text{ USED}}{\#\text{ DAYS BETWEEN READINGS}}$$

$$= \frac{87920\ FT^2}{453\ DAYS} = 194\ \frac{FT^3}{DAY}$$

– CONVERTING $\frac{FT^3}{DAY}$ INTO $FT^3/SECOND$

$$\frac{194\ FT^3}{1\ DAY} \cdot \frac{1\ DAY}{86400\ Sec} = .002\ \frac{FT^3}{S}$$

– MULTIPLY $\frac{FT^3}{S}$ by A FACTOR OF 200%

$$(.002)(200) = .004\ CFS$$

URS CONSULTANTS, INC.

PROJECT BOSTON UNIVERSITY – CENTER FOR PHOTONICS RESEARCH
SUBJECT SANITARY SEWER SYSTEM

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CAPACITY OF 10" SANITARY LINE IN BABBITT ST.

$D = .833'$ $\qquad Q = 0.463\, D^{8/3}\, S^{1/2}/n$

$n = .014$ { CLAY PIPE

$S = .0056$ FT/FT

$Q_{10''} = 1.52$ CFS

EXISTING FLOW IN 10" SANITARY LINE

SEE SEPARATE SHEET FOR BWSC WATER METER READINGS, EXISTING FLOW BASE ON 200% OF WATER METER READINGS AND ESTIMATED FLOW OF BUILDINGS OCCUPYING THE PHOTONICS SITE.

$Q_{EXISTING} \cong .11$ CFS (68589 GPD) × 3.0 (PEAK FACTOR) = .33 CFS

$Q_{RATIO} = .30/1.52 = 20\%$

PROPOSED FLOW TO 10" SANITARY LINE

PROPOSED FLOW FROM PHOTONICS LAB

— EXISTING FLOW FROM 16, 22, 28 BABBITT ST. TO BE DEMOLISHED

$Q_{PHOT} = 10{,}910$ GPD $= .02$ CFS (ENF) − 4500 GPD (.01) = .01 CFS (NET INCREASE)

PROPOSED FLOW IN 10" SANITARY LINE

$Q_{PROP} = Q_{\underset{(NET)}{PHOT}} + Q_{EXISTING}$

$= .01 + .11 = .12$ CFS $\qquad$ PEAK FACTOR = 3.0

$Q_{PEAK} = 3(.11) = .36$ CFS

$Q_{RATIO} = .33/1.52 = .24\ \%$

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STORM DRAINAGE

CALCULATIONS

URS CONSULTANTS, INC.

PROJECT BOSTON UNIVERSITY - CENTER FOR PHOTONICS RESEARCH
SUBJECT STORM DRAINAGE

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PROPOSED FLOW FROM PHOTONICS LAB (ROOF DRAINAGE)

$C = .95$
$i = 5.4$ 10-YEAR STORM $t_c = 5_{MIN}$.
$A = 0.61$ ACRES

$Q_{PHOT} = 3.13$ CFS

TOTAL PROPOSED FLOW TO 15" STORM LINE

$Q_{PROP} = Q_{PHOT} + Q_{CB\ BARRETT\ ST.}$

$= 3.13 + 1.44$

$= 4.57$ CFS > 4.23 CFS CAPACITY OF 15" SD

CAPACITY OF 18" SD @ $S = .010$ FT/FT

$n = .015$ {CAST IRON} $Q = 0.463\, D^{8/3} S^{1/2} / n$
$S = .010$ FT/FT
$D = 1.5$ FT

$Q = 9.10$ CFS > $Q_{PROP} = 4.57$ CFS

$Q_{RATIO} = 4.57/9.10 = 50$ % CAPACITY

PROJECT BOSTON UNIVERSITY - CENTER FOR PHOTONICS RESEARCH
SUBJECT STORM DRAINAGE

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CAPACITY OF 15' STORM LINE IN BABBITT ST.

$n = .014$ {CLAY PIPE} $Q = 0.463\, D^{8/3}\, S^{1/2} / n$
$D = 1.25$ FT.
$S = .005$ FT/FT

$Q = 4.23$ CFS

FLOW TO CATCH BASIN IN BABBITT ST.

$C = .95$
$i = 5.4$ 10-YEAR STORM $T_c = 5$ MIN. (Mass. Highway Dept. Design Manual Chart)
$A = .28$ ACRES

$Q = CiA$
$= (.95)(5.4)(.28) = 1.44$ CFS

FLOW FROM 16 & 22 BABBITT ST. (ROOF DRAINAGE)

$C = .95$
$i = 5.4$ 10-YEAR STORM $T_c = 5$ MIN.
$A = .36$ ACRES

$Q = CiA$
$= 1.85$ CFS

$Q_{EXISTING} = Q_{16 \& 22\ BABBITT} + Q_{CB\ BABBITT}$

$= 1.85 + 1.44 = 3.29$ CFS

$Q_{RATIO} = 3.29 / 4.23 = 78\%$

URS CONSULTANTS, INC.

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FIRE FLOW TESTS

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FIELD REPORTS & TELEPHONE DOCUMENTATION

Boston Water and
Sewer Commission

425 Summer Street
Boston, MA 02210-1700
617-330-9400
Fax 617-330-5167

August 29, 1994

URS Consultants, Inc.
38 Chauncy Street
Boston, Massachusetts 02111

Re: Hydrant Flow Tests
St.Mary's Street & Babbitt Street and
Cummington St. at Commonwealth Avenue

Dear Sir:

As per your request, we conducted the following hydrant flow tests on August 23, 1994. The results are as follows:

St. Mary's Street @ Commonwealth Avenue, Boston

Static	60.0 psi
Residual	38.0 psi
Total Flow	1,186 gpm
Flow @ 20 psi	1,638 gpm

Cummington Street @ Commonwealth Avenue, Boston

Static	58.0 psi
Residential	40.0 psi
Total Flow	1,143 gpm
Flow @ 20 psi	1,711 gpm

I trust that this updated information is what you require. If I can be of further assistance, please feel free to call me.

Yours truly,

John P. Sullivan, Jr., P.E.
Chief Engineer

JPS/AC/mo

Boston Water and Sewer Commission
Hydrant Flow Test Report

Test Hydrant: H32M22G Date: 23-Aug-94 Time: 01:20

Location: Saint Mary's Street @ Commonwealth Avenue

Elevation: 23 feet Tester: Wagner, Liston

Remarks: Test was performed on a 10 inch SL PCI water main (1903).

Gage: Static: 60 Residual: 38

Hydrant	Gage	Diam (in)	Coefficient	PITO (psi)	Flow (gpm)
H24	A	2.5	0.85	14	593
H24	A	2.5	0.85	14	593
					0
					0
					0
					0

Flow Test Results:

Total Flow:	1186 gpm
Flow @20 psi:	1638 gpm
Flow @10 psi:	1847 gpm

Boston Water and Sewer Commission
Hydrant Flow Test Report

Test Hydrant: H28M22H   Date: 23-Aug-94   Time: 01:30

Location: Cummington Street @ Commonwealth Avenue

Elevation: 23 feet   Tester: Wagner, Liston

Remarks: Test was performed on a 8 inch SL PCI water main (1903). This is a private main owned by Boston University

Gage: Static: 58   Residual: 40

Hydrant	Gage	Diam (in)	Coefficient	PITO (psi)	Flow (gpm)
H30	A	2.5	0.85	13	571
H24	A	2.5	0.85	13	571
					0
					0
					0
					0

Flow Test Results:

Total Flow:	1143 gpm
Flow @20 psi:	1711 gpm
Flow @10 psi:	1941 gpm

Boston University
Photonics Lab

Date: July 27,1994

Weather: Overcast

Time: 10 A.M.

Report By: Mark King
Neal Cusick

URS Consultants met with Boston Water and Sewer Commission (BWSC) to observe BWSC conduct fire flow tests on two hydrants within the area of the Photonics Lab Project site. One hydrant (H24) is located on the corner of St. Mary's Street and Babbitt Street, and the other (H28) is located on Cummington Street, just south of Babbitt Street. BWSC conducted a flow test on hydrants H24 and H28, the preliminary results are as follows:

	H24	H28
Static	48 PSI	50 PSI
Residual	31 PSI	29 PSI
Estimated Quantity	1027 GPM	951 GPM
Available at 20 PSI	1345 GPM	1153 GPM

This was updated in BWSC letter Aug. 29, 199

BWSC will send URS Consultants a letter documenting the final results of the flow tests.

URS Consultants investigated the basements of 704-714 Commonwealth Avenue, 110-112 Cummington Street and 16 & 22 Babbitt Street to determine which buildings sanitary lines were flowing to the 10" sanitary line in Babbitt Street the results are as follows:

Address	Flows to
704 Commonwealth Avenue	Babbitt Street
708 Commonwealth Avenue	Babbitt Street
710 Commonwealth Avenue	Commonwealth Avenue
712 Commonwealth Avenue	Could not determine
714 Commonwealth Avenue	Could not determine
110-112 Cummington Street	Cummington Street
16-22 Babbitt Street	Could not determine

Also, URS Consultants verified the addresses that are possibly discharging sanitary flow to the 18" sanitary line in Cummington Street. The average daily uses for these addresses will be obtained from BWSC, and the capacity of the 18" line determined.

fldrep.bu

Documentation Memo

Page ______ of ______

Date: 8-10-94 **Time:** ______

Job Number: 08-44006

Subject: 10" WATER MAIN - CUMMINGTON ST.

Project: B.U. - CENTER FOR PHOTONICS RESEARCH

☐ Phone Call From ☒ Phone Call To

Name: ______

Title: ENGINEERING SERVICES

Organization: BOSTON WATER & SEWER Comm.

Phone Number: (617) 330-9400

☐ Meeting Location: ______

Attendee	Organization

Remarks:

A PHONE CALL WAS MADE TO BWSC TO TRY TO DETERMINE THE OWNERSHIP OF THE 10" LS WATER MAIN IN CUMMINGTON ST. AT THE FIRE FLOW TESTS Jim LISTON, BWSC, HAD STATED THAT BOSTON UNIVERSITY OWNED THE WATER MAIN. THIS WAS REFLECTED IN HIS REPORT, SEE ATTACHED BWSC HYDRANT FLOW TEST REPORT FOR HYDRANT H28M22H. TONY CORREIA, BWSC-ENGINEERING SERVICES, STATED THAT BWSC'S WATER PLANS INDICATED THAT IT WAS A PRIVATE LINE, BUT NEITHER BWSC'S EASEMENT PLANS OR OTHER RECORDS WOULD SHOW WHO OWNED IT. HE STATED THAT THE ABUTTERS WOULD OWN THE LINE. BOSTON UNIVERSITY IS THE ONLY ABUTTER TO THE WATER MAIN IN CUMMINGTON ST.

Action Steps and Person Responsible: ______

Copies to: R. CARPENITO
FILE

Signed:

URS CONSULTANTS

Form GO-5
Rev 3/87
Doc 0030F

Documentation Memo

Page ______ of ______

Date: 7-27-94 Time: ______

Job Number: 08-44006

Subject: BROOKLINE SEWER IN ST. MARY'S ST.

Project: B.U. - CENTER FOR PHOTONICS RESEARCH

☐ Phone Call From ☒ Phone Call To

Name: ENGINEERING DEPT.

Title: TOWN OF BROOKLINE

Organization: (617) 730-2156

Phone Number:

☐ Meeting Location: ______

Attendee	Organization

Remarks:

A PHONE CALL WAS MADE TO THE TOWN OF BROOKLINE'S ENGINEERING DEPT. TO TRY TO DETERMINE IF THE 84" X 89" BROOKLINE SEWER IN ST. MARY'S ST. WAS A COMBINED SEWER. THE BWSC PLANS SHOWED BOTH SANITARY FLOW AND STORM FLOW OUTLETTING TO THIS SEWER. THE ENGINEERING DEPT. STATED THAT IT WAS A COMBINED SEWER ACCORDING TO THEIR RECORDS.

Action Steps and Person Responsible: ______

Copies to: R. CARPENITO
FILE

Signed: ______

URS CONSULTANTS

Form GO-5
Rev. 3/87
Doc. 0030F

URS CONSULTANTS, INC.

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BWSC METER READINGS

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BESS                                   BILLING HISTORY FOR A CONNECT                                            BILL_HIST_RPT
---------------------------------------------------------------------------------------------------------------------------
DATE: 25-Jul-1994                                                                                                PAGE:    1
                                      ACCOUNT NUMBER: 283695000
                                        SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                     SERVICE ADDRESS: 704 COMMONWEALTH AVE
                                      CITY STATE ZIP: BOSTON, MA 02215-2404
---------------------------------------------------------------------------------------------------------------------------
BILL      CURRENT  RD   PREVIOUS  RD            BALANCE      WATER      SEWER     ---- PERIOD POSTINGS ----      BILL
DATE      READING  CD    READING  CD    CONS    FORWARD     CHARGE     CHARGE         DATE      AMOUNT   TY     AMOUNT
---------------------------------------------------------------------------------------------------------------------------

07/01/94   413979  EE     408624  EE    5355     230.94     107.05     186.87      07/01/94      29.40   F4     413.32
                                                                                  08/28/94    -230.94   99
                                                                                  08/16/94      90.00   36

05/27/94   408624  EE     404799  EE    3825     314.08      76.46     133.48      05/27/94    -314.08   99     230.94
                                                                                  05/27/94      21.00   F4

05/02/94   404799  EE     399597  EE    5202     558.63     103.99     181.53      05/02/94    -267.89   99     314.08
                                                                                  05/02/94      28.56   F4
                                                                                  04/05/94    -290.74   99

03/29/94   399597  EE     395160  025   4437     623.30      88.70     154.83      03/29/94      24.36   F4     558.63
                                                                                  03/02/94    -332.56   99

03/01/94   395160  025    390338  EE    4822     332.56      96.40     168.30      03/01/94      26.04   F4     623.30
01/28/94   390338  EE     384830  151   5508     197.03     110.11     192.21      01/28/94      30.24   F4     332.56
                                                                                  01/28/94    -197.03   99

12/27/93   384830  151    381603  EE    3227     457.62      64.49     112.44      12/27/93      -0.06   50     197.03
                                                                                  12/27/93      20.16   F4
                                                                                  12/21/93    -303.57   99
                                                                                  12/08/93    -154.05   99

11/29/93   381603  EE     376550  093   5053     154.05     101.03     176.50      11/29/93      26.04   F4     457.62
11/01/93   376550  093    374170  EE    2380     884.11      47.50      82.32      11/01/93      -0.97   50     154.05
                                                                                  11/01/93      25.20   F4
                                                                                  10/21/93    -389.14   99
                                                                                  09/30/93    -494.97   99

09/29/93   374170  EE     367570  059   6600     494.97     132.14     231.80      09/29/93      25.20   F4     884.11
09/01/93   367570  059    359080  EE    8490     880.39     170.10     298.97      09/01/93      -0.98   50     494.97
                                                                                  09/01/93      26.88   F4
                                                                                  08/18/93    -358.95   99
                                                                                  08/02/93    -523.44   99

07/29/93   359080  EE     353032  EE    6048     523.44     121.08     212.35      07/29/93      23.52   F4     880.39
07/01/93   353032  EE     345688  EE    7344     382.45     147.03     257.85      07/01/93      28.56   F4     523.44
                                                                                  06/16/93    -382.45   99
                                                                                  06/15/93      90.00   36

05/28/93   345688  EE     339208  EE    6480     382.45     129.73     227.52      05/28/93      25.20   F4     382.45
                                                                                  05/18/93    -382.45   99
---------------------------------------------------------------------------------------------------------------------------
```

DATE: 25-Jul-1994

ACCOUNT NUMBER: 283695000
SERVICE NAME: BOSTON UNV PHYSICAL PLANT
SERVICE ADDRESS: 704 COMMONWEALTH AVE
CITY STATE ZIP: BOSTON, MA 02215-2404

BILL DATE	CURRENT READING	RD CD	PREVIOUS READING	RD CD	CONS	BALANCE FORWARD	WATER CHARGE	SEWER CHARGE	PERIOD POSTINGS DATE	PERIOD POSTINGS AMOUNT	PERIOD POSTINGS TY	BILL AMOUNT
04/28/93	339208	EE	332728	EE	6480	356.95	129.73	227.52	04/28/93 04/20/93	25.20 -356.95	F4 99	382.45
03/29/93	332728	EE	326680	EE	6048	1111.50	121.08	212.35	03/29/93 03/15/93 03/08/93	23.52 -395.20 -716.30	F4 99 99	356.95
03/01/93	326680	EE	319984	EE	6696	716.30	134.06	235.10	03/01/93	26.04	F4	1111.50
01/29/93	319984	EE	307240	075	12744	816.65	250.13	416.31	01/29/93 01/15/93	49.86 -816.65	F4 99	716.30
— 12/03/92	307240	075	292035	EE	15205	1093.35	292.59	460.31	12/03/92 10/20/92	63.75 -1093.35	F4 99	816.65
09/17/92	292035	EE	273250	EE	18785	1180.41	361.60	569.50	09/17/92 07/31/92 06/29/92	72.25 -1180.41 90.00	F4 99 36	1093.35
06/24/92	273250	EE	251150	043	22100	279.52	425.41	670.00	06/24/92 04/27/92	85.00 -279.52	F4 99	1180.41
03/20/92	251150	043	248976	EE	2174	1690.32	40.86	61.86	03/20/92 03/20/92 01/30/92	64.60 112.20 -1690.32	F4 50 99	279.52
12/18/91	248976	EE	208400	031	40576	865.47	683.27	938.05	12/18/91 10/09/91	69.00 -865.47	F4 99	1690.32
09/17/91	208400	031	188450	EE	19950	1181.36	336.08	462.22	09/17/91 09/17/91 07/17/91	69.00 -1.83 -1181.36	F4 50 99	865.47
06/19/91	188450	EE	160604	EE	27846	1246.33	468.86	643.50	06/19/91 04/22/91	69.00 -1246.33	F4 99	1181.36
03/20/91	160604	EE	130310	075	30294	2916.60	500.14	677.19	03/20/91 01/28/91	69.00 -2916.60	F4 99	1246.33
12/17/90	130310	075	101980	025	28330	1842.77	431.03	548.93	12/17/90 12/17/90	66.00 27.87	F4 96	2916.60
09/17/90	101980	025	50498	EE	51482	553.51	784.87	1008.02	09/17/90 09/17/90 09/17/90 08/10/90	66.00 1.09 -17.21 -553.51	F4 96 50 99	1842.77

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BESS                                     BILLING HISTORY FOR A CONNECT                                      BILL_HIST_RPT
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DATE: 25-Jul-1994                                                                                              PAGE:   3
                                     ACCOUNT NUMBER: 283695000
                                       SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                    SERVICE ADDRESS: 704 COMMONWEALTH AVE
                                     CITY STATE ZIP: BOSTON, MA 02215-2404
------------------------------------------------------------------------------------------------------------------------
BILL       CURRENT  RD    PREVIOUS  RD             BALANCE      WATER       SEWER     ---- PERIOD POSTINGS ----    BILL
DATE       READING  CD     READING  CD     CONS    FORWARD      CHARGE      CHARGE        DATE      AMOUNT   TY    AMOUNT
------------------------------------------------------------------------------------------------------------------------

06/20/90     50498  EE       36302  EE    14196     573.47      215.48      272.03    06/20/90       66.00   F4    553.51
                                                                                      04/24/90     -573.47   99

03/21/90     36302  EE       21170  075   15132     495.62      228.05      279.42    03/21/90       66.00   F4    573.47
                                                                                      01/16/90     -495.62   99

12/18/89     21170  075       7334  EE    13836     553.31      204.43      229.19    12/18/89       62.00   F4    495.62
                                                                                      10/17/89     -553.31   99

09/18/89      7334  EE     1761161  003   15671     502.93      231.58      259.73    09/18/89       62.00   F4    553.31
                                                                                      07/21/89     -502.93   99

06/19/89   1761161  003    1747090  076   14071     388.30      207.90      233.03    06/19/89       62.00   F4    502.93
                                                                                      04/24/89     -388.30   99

03/22/89   1747090  076    1736859  EE    10231     478.18      147.53      162.74    03/22/89       62.00   F4    388.30
                                                                                      03/22/89       15.87   50
                                                                                      03/22/89        0.16   98
                                                                                      02/03/89     -478.18   99

12/19/88   1736859  EE     1719690  24    17169     364.58      211.08      210.35    12/19/88       56.75   F4    478.18
                                                                                      11/01/88     -364.58   99

09/19/88   1719690  24     1707120  25    12570     765.04      154.40      153.43    09/19/88       56.75   F4    364.58
                                                                                      07/15/88     -765.04   99

06/20/88   1707120  25     1677020  60    30100     910.89      343.26      356.34    06/20/88       56.75   F4    765.04
                                                                                      06/20/88        8.69   96
                                                                                      05/27/88     -910.89   99

03/14/88   1677020  60     1627850  59    49170     -83.21      436.89      516.96    03/14/88       40.25   F4    910.89

12/16/87   1627850  59     1636902  EE    -9052     592.86      -80.10      -93.36    12/16/87       40.25   F4    -83.21
                                                                                      12/15/87       50.00   38
                                                                                      10/28/87     -592.86   99

09/28/87   1636902  EE     1608328  EE    28574     624.00      253.47      298.11    09/28/87       40.25   F4    592.86
                                                                                      09/28/87        1.03   96
                                                                                      08/18/87     -624.00   99

06/29/87   1608328  EE     1580382  EE    27946    1520.17      246.83      287.19    06/29/87       39.98   F4    624.00
                                                                                      06/12/87       50.00   38
                                                                                      05/08/87     -578.46   99
                                                                                      04/17/87     -941.71   99

04/01/87   1580382  EE     1551180  EE    29202     941.71      251.44      273.41    04/01/87       38.75   F4   1520.17
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BESS                                          BILLING HISTORY FOR A CONNECT                                              BILL_HIST_RPT
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DATE: 25-jul-1994                                                                                                           PAGE:    4
                                           ACCOUNT NUMBER: 283895000
                                             SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                          SERVICE ADDRESS: 704 COMMONWEALTH AVE
                                           CITY STATE ZIP: BOSTON, MA 02215-2404
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BILL        CURRENT   RD   PREVIOUS   RD                  BALANCE        WATER        SEWER      ---- PERIOD POSTINGS ----       BILL
DATE        READING   CO    READING   CO        CONS      FORWARD        CHARGE       CHARGE       DATE       AMOUNT    TV     AMOUNT
---------------------------------------------------------------------------------------------------------------------------------------
                                                                                                 04/01/87      14.86    96

12/29/86    1551180   EE    1500940   60       50240      1001.98        432.59       470.37     12/29/86      38.75    F4     941.71
                                                                                                 08/11/86   -1001.98    99

07/23/86    1500940   60    1450510   EE       50430       290.40        435.27       477.37     07/23/86      38.58    F4    1001.98
                                                                                                 07/23/86       0.76    96
                                                                                                 07/10/86      50.00    36
                                                                                                 06/27/86    -290.40    99

05/05/86    1450510   EE    1433710   EE       16800       360.82        130.52       120.88     05/05/86      39.00    F4     290.40
                                                                                                 03/20/86    -360.82    99

02/24/86    1433710   EE    1411870   EE       21840       524.95        168.27       153.55     02/24/86      39.00    F4     360.82
                                                                                                 12/17/85    -524.95    99

11/25/85    1411870   EE    1386910   51       24960       273.73        192.30       175.49     11/25/85     157.16    F4     524.95
                                                                                                 09/16/85    -273.73    99

08/19/85    1386910   51    1367370   99       19540       369.59        149.25       124.48     08/06/85    -369.59    99     273.73

05/13/85    1367370   99    1340800   EE       26570       829.04        202.73       166.86     04/16/85    -829.04    99     369.59

03/24/85    1340800   EE    1281200   99       59600       660.86        454.75       374.29     12/07/84    -660.86    99     829.04

11/07/84    1281200   99    1233690   99       47510       865.47        362.50       298.36     09/24/84    -865.47    99     660.86

08/28/84    1233690   99    1169400   99       64290       732.41        486.08       379.39     03/14/84    -732.41    99     865.47

02/27/84    1169400   99    1112800   99       56600       392.08        423.37       309.04     12/14/83    -392.08    99     732.41

11/21/83    1112800   99    1082500   EE       30300       406.31        226.64       165.44     09/27/83    -406.31    99     392.08

09/13/83    1082500   EE    1051100   EE       31400       363.62        234.87       171.44     07/13/83    -363.62    99     406.31

06/23/83    1051100   EE    1023000   EE       28100       453.91        210.19       153.43     04/08/83    -453.91    99     363.62

03/24/83    1023000   EE     987000   EE       36000       347.22        271.14       182.77     12/17/82    -347.22    99     453.91

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BESS                                  BILLING HISTORY FOR A CONNECT                                          BILL_HIST_RPT
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DATE: 25-Jul-1994                                                                                             PAGE:   1
                                        ACCOUNT NUMBER: 283688000
                                          SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                       SERVICE ADDRESS: 708 COMMONWEALTH AVE
                                        CITY STATE ZIP: BOSTON, MA 02215-2423
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BILL      CURRENT  RD  PREVIOUS  RD             BALANCE     WATER      SEWER    ---- PERIOD POSTINGS ----      BILL
DATE      READING  CD  READING   CD    CONS     FORWARD     CHARGE     CHARGE      DATE      AMOUNT   TY      AMOUNT
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07/01/94  2289020  EE  2284750   EE    4270      167.07      85.32     148.59   06/28/94    -167.07   99      233.91

05/27/94  2284750  EE  2281700   EE    3050      227.22      60.94     106.13   05/27/94    -227.22   99      187.07

05/02/94  2281700  EE  2277552   EE    4148      400.97      82.88     144.34   05/02/94    -187.12   99      227.22
                                                                                04/05/94    -213.85   99

03/29/94  2277552  EE  2274136   EE    3416      454.43      68.25     118.87   03/02/94    -240.58   99      400.97

03/01/94  2274136  EE  2270232   EE    3904      240.58      78.00     135.85                                 454.43

01/28/94  2270232  EE  2265840   151   4392      283.34      87.75     152.83   01/28/94    -283.34   99      240.58

12/27/93  2265840  151 2260270   029   5570      855.42     111.26     193.57   12/21/93    -711.13   99      283.34
                                                                                12/06/93    -165.78   99

11/29/93  2260270  029 2247830   EE   12440      165.78     251.76     459.37   11/29/93     -21.49   50      855.42

11/01/93  2247830  EE  2244794   EE    3036      217.32      60.61     105.17   10/21/93    -140.86   99      165.78
                                                                                09/30/93     -76.68   99

09/29/93  2244794  EE  2242218   EE    2576       76.66      51.43      89.23                                 217.32

09/01/93  2242218  EE  2239090   EE    3128      607.55      62.45     108.38   08/18/93    -150.71   99       78.66
                                                                                08/02/93    -550.99   99

07/29/93  2239090  EE  2236330   104   2760      456.84      55.10      95.61                                 607.55

07/01/93  2236330  104 2234599   EE    1731      565.11      34.52      59.63   07/01/93      -0.40   50      456.84
                                                                                06/16/93    -202.02   99

05/28/93  2234599  EE  2230910   104   3689      552.64      73.70     128.32   05/18/93    -189.55   99      565.11

04/28/93  2230910  104 2227449   EE    3461      565.11      69.15     120.40   04/20/93    -202.02   99      552.64

03/29/93  2227449  EE  2223760   056   3689     1208.02      73.70     128.32   03/15/93    -560.79   99      565.11
                                                                                03/08/93    -284.14   99

03/01/93  2223760  056 2213638   EE   10122      647.23     202.98     357.81                                1208.02

01/29/93  2213638  EE  2208166   EE    5472     -107.10     107.19     176.95   12/09/92     470.19   88      647.23

12/03/92  2208166  EE  2200774   EE    7392     -470.19     141.90     221.19                                -107.10

09/17/92  2200774  EE  2191750   043   9024     -913.45     173.23     270.03   09/17/92       0.00   45     -470.19

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DATE: 25-Jul-1994

ACCOUNT NUMBER: 283688000
SERVICE NAME: BOSTON UNV PHYSICAL PLANT
SERVICE ADDRESS: 708 COMMONWEALTH AVE
CITY STATE ZIP: BOSTON, MA 02215-2423

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BILL DATE	CURRENT READING	RD CD	PREVIOUS READING	RD CD	CONS	BALANCE FORWARD	WATER CHARGE	SEWER CHARGE	PERIOD POSTINGS DATE	PERIOD POSTINGS AMOUNT	TV	BILL AMOUNT
06/24/92	2191750	043	2215345	EE	8490	736.05	162.99	254.12	06/24/92 04/27/92 03/21/92 03/21/92	0.00 -736.05 -779.25 -551.31	45 99 83 82	-913.45
03/20/92	2215345	EE	2200000	EE	15345	602.47	289.81	446.24	01/30/92 12/28/91	-602.47 0.00	99 45	736.05
12/18/91	2200000	EE	2184820	EE	15180	589.37	255.05	347.42	10/09/91	-589.37	99	602.47
09/17/91	2184820	EE	2169970	EE	14850	595.92	249.50	339.87	07/17/91	-595.92	99	589.37
06/19/91	2169970	EE	2154955	EE	15015	208.02	252.28	343.64	04/22/91	-208.02	99	595.92
03/20/91	2154955	EE	2138620	075	16335	-422.72	269.11	361.63				208.02
12/17/90	2138620	075	2123470	025	15150	-943.48	230.03	290.73				-422.72
09/17/90	2123470	025	2153282	EE	12904	725.23	195.87	247.23	08/10/90 06/21/90 06/21/90	-725.23 -750.45 -636.13	99 83 82	-943.48
06/20/90	2153282	EE	2132261	EE	21021	725.81	319.55	405.68	04/24/90	-725.81	99	725.23
03/21/90	2132261	EE	2110778	EE	21483	661.67	324.53	401.28	01/16/90	-661.67	99	725.81
12/18/89	2110778	EE	2089757	EE	21021	661.67	311.08	350.59	10/17/89	-661.67	99	661.67
09/18/89	2089757	EE	2068736	EE	21021	647.14	311.08	350.59	07/21/89	-647.14	99	661.67
06/19/89	2068736	EE	2048177	EE	20559	680.08	304.25	342.89	04/24/89	-680.08	99	647.14
03/22/89	2048177	EE	2025770	59	22407	407.75	322.39	357.56	03/22/89 02/03/89	0.13 -407.75	96 99	680.08
12/19/88	2025770	59	2003150	24	22620	-149.29	278.44	278.60				407.75
09/14/88	2003150	24	1989430	25	13720	-485.49	168.57	167.63				-149.29
06/20/88	1989430	25	1993608	EE	-4178	-453.38	-48.52	-48.86	06/20/88	65.27	50	-485.49
03/14/88	1993608	EE	2017314	EE	27768	687.08	246.31	289.68	01/26/88 12/17/87 12/17/87 12/17/87	-687.08 -527.32 -453.73 -8.32	99 83 82 84	-453.38

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BESS                                   BILLING HISTORY FOR A CONNECT                                   BILL_HIST_RPT
-----------------------------------------------------------------------------------------------------------------
DATE: 25-jul-1994                                                                                   PAGE:     3
                                         ACCOUNT NUMBER: 283688000
                                           SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                        SERVICE ADDRESS: 708 COMMONWEALTH AVE
                                         CITY STATE ZIP: BOSTON, MA 02215-2423
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BILL      CURRENT  RD   PREVIOUS  RD               BALANCE      WATER       SEWER   ---- PERIOD POSTINGS ----     BILL
DATE      READING  CD    READING  CD       CONS    FORWARD     CHARGE      CHARGE        DATE     AMOUNT  TY    AMOUNT
-----------------------------------------------------------------------------------------------------------------

12/16/87  2017314  EE    1981843  EE      35471     792.71     315.01      372.07    10/28/87    -792.71  99    687.08

09/28/87  1981843  EE    1940984  EE      40859     766.27     362.86      428.59    09/28/87       1.26  96    792.71
                                                                                     08/18/87    -766.27  99

06/29/87  1940984  EE    1901023  EE      39961     954.49     353.37      412.90    05/08/87    -954.49  99    766.27

04/01/87  1901023  EE    1848490  65      52533    1073.53     452.88      494.55    04/01/87       7.06  96    954.49
                                                                                     02/18/87   -1073.53  99

12/15/86  1848490  65    1788950  60      59540     852.70     513.24      560.29    08/26/86    -852.70  99   1073.53

07/30/86  1788950  60    1739920  60      49030     399.34     413.84      438.86    05/23/86    -399.34  99    852.70

04/14/86  1739920  60    1713020  EE      26900    1031.74     207.91      191.43    03/20/86   -1031.74  99    399.34

02/24/86  1713020  EE    1643480  51      69540     729.74     537.34      494.40    12/17/85    -729.74  99   1031.74

11/25/85  1643480  51    1594380  51      49100     166.44     379.68      350.06    09/16/85    -166.44  99    729.74

08/19/85  1594380  51    1574090  99      20290    -117.82     154.99      129.27                               166.44

06/29/85  1574090  99    1582560  99      -8470     555.56     -64.63      -53.19    04/09/85    -555.56  99   -117.82

03/10/85  1582560  99    1542620  99      39940     694.66     304.74      250.82    12/07/84    -694.66  99    555.56

11/07/84  1542620  99    1492680  99      49940    1595.16     381.04      313.62    10/04/84   -1595.16  99    694.66

09/10/84  1492680  99    1371700  99     120980     739.67     914.80      714.50    03/14/84    -773.81  99   1595.16

02/27/84  1371700  99    1311900  99      59800     177.28     447.30      326.51    02/27/84       5.31  85    739.67
                                                                                     02/27/84     -39.45  83
                                                                                     12/14/83    -177.28  99

11/21/83  1311900  99    1298200  99      13700    2440.49     102.48       74.80    09/27/83   -2440.49  99    177.28

09/13/83  1298200  99    1109600  EE     188600     187.63    1410.73     1029.76    07/13/83    -187.63  99   2440.49

06/23/83  1109600  EE    1095100  EE      14500     234.50     108.46       79.17    04/19/83    -234.50  99    187.63

03/24/83  1095100  EE    1076500  EE      18600     179.86     140.09       94.41    12/17/82    -179.86  99    234.50



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DATE: 25-Jul-1994

ACCOUNT NUMBER: 263681001
SERVICE NAME: BOSTON UNV PHYSICAL PLANT
SERVICE ADDRESS: 710 COMMONWEALTH AVE
CITY STATE ZIP: BOSTON, MA 02215-2423

BILL DATE	CURRENT READING	RD CD	PREVIOUS READING	RD CD	CONS	BALANCE FORWARD	WATER CHARGE	SEWER CHARGE	---- PERIOD POSTINGS ---- DATE	AMOUNT	TY	BILL AMOUNT
07/01/94	753831	EE	746586	EE	7245	-780.99	145.02	254.20				-381.77
05/27/94	746586	EE	741411	EE	5175	-1066.15	103.59	181.57				-780.99
05/02/94	741411	EE	734373	EE	7038	-1453.97	140.88	246.94				-1066.15
03/29/94	734373	EE	728370	025	6003	-1364.42	120.16	210.62	03/02/94	-420.33	99	-1453.97
→ 03/01/94	728370	025	765882	EE	-37512	420.33	-755.32	-1353.02	03/01/94	323.59	50	-1364.42
01/28/94	765882	EE	758266	EE	7616	367.78	152.53	267.80	01/26/94	-367.78	99	420.33
12/27/93	758266	EE	751602	EE	6664	801.25	133.46	234.32	12/21/93 12/06/93	-367.78 -433.47	99 99	367.78
11/29/93	751602	EE	744938	EE	6664	433.47	133.46	234.32				801.25
11/01/93	744938	EE	737084	EE	7854	814.37	157.30	276.17	10/21/93 09/30/93	-367.78 -446.59	99 99	433.47
09/29/93	737084	EE	730420	EE	6664	446.59	133.46	234.32				814.37
09/01/93	730420	EE	722328	EE	8092	814.37	162.06	284.53	08/16/93 08/02/93	-367.78 -446.59	99 99	446.59
07/29/93	722328	EE	715664	EE	6664	446.59	133.46	234.32				814.37
07/01/93	715664	EE	707572	EE	8092	394.06	162.06	284.53	06/16/93	-394.06	99	446.59
05/28/93	707572	EE	700432	EE	7140	50.35	143.00	251.06	05/18/93	-50.35	99	394.06
10 04/28/93	700432	EE	693292	EE	7140	-343.71	143.00	251.06				50.35
03/29/93	693292	EE	686628	EE	6664	1118.68	133.46	234.32	03/15/93 03/08/93	-407.19 -1422.98	99 99	-343.71
→ 12 03/01/93	686628	EE	679250	EE	7378	711.49	147.76	259.43				1118.68
13 01/29/93	679250	EE	665684	EE	13566	909.06	266.54	444.95	01/15/93	-909.06	99	711.49
12/03/92	665684	EE	647358	EE	18326	1003.51	352.86	556.20	10/23/92	-1003.51	99	909.06
09/17/92	647358	EE	627128	EE	20230	1133.37	389.52	613.99	07/31/92	-1133.37	99	1003.51
14 06/24/92	627128	EE	604280	EE	22848	1066.89	439.92	693.45	04/27/92	-1066.89	99	1133.37

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BESS                                       BILLING HISTORY FOR A CONNECT                                      BILL_HIST_RPT
-----------------------------------------------------------------------------------------------------------------------
DATE: 25-Jul-1994                                                                                          PAGE:    4
                                          ACCOUNT NUMBER: 283881001
                                            SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                         SERVICE ADDRESS: 710 COMMONWEALTH AVE
                                          CITY STATE ZIP: BOSTON, MA 02215-2423
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BILL        CURRENT  RD    PREVIOUS  RD             BALANCE       WATER        SEWER    ---- PERIOD POSTINGS ----      BILL
DATE        READING  CD     READING  CD      CONS   FORWARD      CHARGE       CHARGE        DATE      AMOUNT   TY    AMOUNT
-----------------------------------------------------------------------------------------------------------------------

03/20/92     604280  EE      582146  EE     22134    872.78      418.66       648.23    01/30/92     -872.78   99   1066.89

12/18/91     582146  EE      560250  EE     21896    853.82      368.41       504.37    10/09/91     -853.82   99    872.78

09/17/91     560250  EE      538830  EE     21420    863.30      360.41       493.41    07/17/91     -863.30   99    853.82

06/19/91     538830  EE      517172  EE     21658    913.72      364.41       498.89    04/22/91     -913.72   99    863.30

03/20/91     517172  EE      493610  075    23562    494.08      388.72       525.00    01/28/91     -494.08   99    913.72

12/17/90     493610  075     470530  025    23080   -302.97      380.87       446.08                                 494.08

09/17/90     470530  025     479419  EE     -8889    655.48     -134.80      -169.46    09/17/90        1.29   96   -302.97
                                                                                        08/10/90     -655.48   99

06/20/90     479419  EE      460400  EE     19019    656.00      289.02       366.46    04/24/90     -656.00   99    655.48

03/21/90     460400  EE      440963  EE     19437    598.05      293.52       362.48    01/18/90     -598.05   99    656.00

12/18/89     440963  EE      421944  EE     19019    635.74      281.35       318.70    10/17/89     -635.74   99    598.05

09/18/89     421944  EE      401880  003    20064   1049.90      296.81       334.10    09/18/89        4.83   96    635.74
                                                                                        08/17/89    -1049.90   99

06/19/89     401880  003     366810  EE     35070    740.70      519.91       589.94    08/19/89        6.03   96   1049.90
                                                                                        08/19/89      -85.98   50
                                                                                        05/10/89     -740.70   99

03/22/89     366810  EE      353697  EE     13113    336.31      189.48       209.58    03/22/89        5.33   96    740.70

12/19/88     353697  EE      340020  24     13677   1479.64      188.00       166.98    12/19/88       21.33   96    336.31
                                                                                        12/15/88     -749.84   99
                                                                                        10/12/88     -250.00   99
                                                                                        10/06/88     -500.00   99

09/19/88     340020  24      328340  25     11680   2204.85      143.43       142.44    08/30/88     -250.00   99   1479.64
                                                                                        06/21/88     -761.08   85

06/20/88     328340  25      309100  59     19240   1759.45      219.09       226.31                                2204.85

03/14/88     309100  59      300534  EE      8566   1950.78       75.75        88.07    03/14/88       45.37   96   1759.45
                                                                                        03/14/88       -0.52   50
                                                                                        01/25/88     -400.00   99

12/16/87     300534  EE      282048  EE     18486   1758.55      163.86       192.18    12/16/87       36.19   96   1950.78
                                                                                        10/31/87     -200.00   99

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BESS                                    BILLING HISTORY FOR A CONNECT                                    BILL_HIST_RPT
----------------------------------------------------------------------------------------------------------------------
DATE: 25-Jul-1994                                                                                        PAGE:     5
                                    ACCOUNT NUMBER: 283681001
                                      SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                   SERVICE ADDRESS: 710 COMMONWEALTH AVE
                                    CITY STATE ZIP: BOSTON, MA 02215-2423
----------------------------------------------------------------------------------------------------------------------
BILL       CURRENT  RD   PREVIOUS  RD              BALANCE       WATER       SEWER   ---- PERIOD POSTINGS ----     BILL
DATE       READING  CD    READING  CD       CONS   FORWARD       CHARGE      CHARGE      DATE       AMOUNT   TV    AMOUNT
----------------------------------------------------------------------------------------------------------------------

09/28/87    282048  EE     259350  34      22698   1368.77       201.19      235.97   09/28/87       33.16   96   1758.55
                                                                                      07/24/87      -80.54   99

06/29/87    259350  34     237720  25      21630   2114.60       190.23      218.71   06/29/87       31.19   96   1368.77
                                                                                      06/18/87      -80.54   99
                                                                                      05/19/87      -80.54   99
                                                                                      04/28/87     -541.66   99
                                                                                      04/23/87     -402.68   85
                                                                                      04/15/87      -80.54   99

04/01/87    237720  25     209790  65      27930   1653.48       240.39      261.00   04/01/87       40.27   96   2114.60
                                                                                      02/18/87      -80.54   99

12/29/86    209790  65     175220  60      34570   1766.11       297.51      322.87   12/29/86       88.99   96   1653.48
                                                                                      11/18/86     -500.00   99
                                                                                      09/18/86     -300.00   99

07/30/86    175220  60     157670  60      17550   1428.27       147.63      154.74   07/30/86       35.47   96   1766.11

05/05/86    157670  60     135120  25      22550   1074.76       173.81      158.80   05/05/86       20.90   96   1428.27

02/24/86    135120  25     117500  51      17620    795.73       135.69      123.86   02/24/86       19.68   96   1074.76

11/25/85    117500  51      98580  99      18920    857.11       145.80      133.15   11/25/85       17.08   96    795.73
                                                                                      09/19/85     -357.41   99

08/19/85     98580  99      85730  99      12850    663.73        98.14       81.80   08/19/85       13.44   96    857.11

05/29/85     85730  99      64080  99      21650    357.41       165.19      135.96   05/29/85        5.17   96    663.73

03/24/85     64080  99      51530  99      12550    181.37        95.76       78.81   03/24/85        1.47   96    357.41

01/15/85     51530  99      38980  99      12550    303.97        95.76       78.81   01/15/85        6.80   96    181.37
                                                                                      12/19/84     -303.97   99

08/28/84     38980  99      18400  99      22580      0.00       170.72      133.26                                 303.97

02/27/84     18400  99       6000  99      10400      0.00         0.00        0.00                                   0:00

11/21/83      6000  99          0  99       6000      0.00         0.00        0.00                                   0.00


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BESS                                     BILLING HISTORY FOR A CONNECT                                      BILL_HIST_RPT
-----------------------------------------------------------------------------------------------------------------------
DATE: 25-Jul-1994                                                                                            PAGE:    1
                                          ACCOUNT NUMBER: 283874000
                                            SERVICE NAME: GEORGOPOULOS, CONSTANTINE
                                         SERVICE ADDRESS: 712 COMMONWEALTH AVE
                                          CITY STATE ZIP: BOSTON, MA 02215-2414
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BILL      CURRENT  RD    PREVIOUS  RD                BALANCE      WATER      SEWER    ---- PERIOD POSTINGS ----     BILL
DATE      READING  CD    READING   CD       CONS     FORWARD      CHARGE     CHARGE       DATE      AMOUNT   TV    AMOUNT
-----------------------------------------------------------------------------------------------------------------------

07/01/94   259030  EE     257735   EE       1295      356.80      25.80      44.39    07/01/94     -2.35   44    457.13
                                                                                      07/01/94      3.09   96
                                                                                      07/01/94     29.40   F4

05/27/94   257735  EE     256810   EE        925      284.21      18.43      31.70    05/27/94      1.46   96    356.80
                                                                                      05/27/94     21.00   F4

05/02/94   256810  EE     255552   EE       1258      186.66      25.07      43.12    05/02/94      0.80   96    284.21
                                                                                      05/02/94     28.56   F4

03/29/94   255552  EE     254516   EE       1036      106.90      20.64      35.51    03/29/94      0.09   96    186.66
                                                                                      03/29/94     23.52   F4

03/01/94   254516  EE     253332   EE       1184       15.85      23.59      40.58    03/01/94     26.88   F4    106.90

01/28/94   253332  EE     252000   151      1332      -86.58      26.64      45.65    01/28/94     30.24   F4     15.85

✓12/27/93  252000  151    251364   EE        636     -141.08      12.67      21.75    12/27/93     -0.08   50    -86.58
                                                                                      12/27/93     20.16   F4

11/29/93   251364  EE     250000   093      1364     -241.17      27.19      46.86    11/29/93     26.04   F4   -141.08

11/01/93   250000  093    249666   EE        334     -284.41       6.65      11.39    11/01/93     25.20   F4   -241.17

09/29/93   249666  EE     248378   EE       1288     -377.89      25.68      44.28    09/29/93     23.52   F4   -284.41

09/01/93   248378  EE     246814   EE       1564     -491.39      31.18      53.76    09/01/93     28.56   F4   -377.89

07/29/93   246814  EE     245526   EE       1288     -584.87      25.68      44.28    07/29/93     23.52   F4   -491.39

07/01/93   245526  EE     243962   EE       1564     -698.37      31.18      53.76    07/01/93     28.58   F4   -584.87

05/28/93   243962  EE     242582   EE       1380     -798.52      27.51      47.44    05/28/93     25.20   F4   -698.37

04/28/93   242582  EE     241202   EE       1380     -898.67      27.51      47.44    04/28/93     25.20   F4   -798.52

03/29/93   241202  EE     239914   EE       1288     -992.15      25.68      44.28    03/29/93     23.52   F4   -898.67

03/01/93   239914  EE     238488   EE       1426    -1095.64      28.43      49.02    03/01/93     26.04   F4   -992.15

01/29/93   238488  EE     235866   EE       2622    -1279.15      51.28      84.07    01/29/93     48.16   F4  -1095.64

12/03/92   235866  EE     232324   EE       3542    -1517.57      67.88     105.09    12/03/92     65.45   F4  -1279.15

09/17/92   232324  EE     228000   043      4324    -1808.63      82.87     128.29    09/17/92     79.90   F4  -1517.57
                                                                                      09/17/92      0.00   45
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DATE: 25-Jul-1994
                                       ACCOUNT NUMBER: 283874000
                                         SERVICE NAME: GEORGOPOULOS, CONSTANTINE
                                      SERVICE ADDRESS: 712 COMMONWEALTH AVE
                                       CITY STATE ZIP: BOSTON, MA 02215-2414
-------------------------------------------------------------------------------------------------------------------------------
BILL       CURRENT  RD     PREVIOUS  RD                BALANCE       WATER       SEWER     ---- PERIOD POSTINGS ----      BILL
DATE       READING  CD      READING  CD       CONS     FORWARD      CHARGE      CHARGE        DATE       AMOUNT   TV     AMOUNT
-------------------------------------------------------------------------------------------------------------------------------

06/24/92    228000  043      274750  EE       4284     1158.41       82.12      127.22     06/24/92       73.95  F4   -1808.63
                                                                                          06/24/92        0.00  45
                                                                                          06/08/92    -1158.41  99
                                                                                          03/21/92    -1158.78  83
                                                                                          03/21/92     -847.68  82
                                                                                          03/21/92      -85.46  84

03/20/92    274750  EE       263125  EE      11625      524.32      219.40      337.04     03/20/92        9.65  96    1158.41
                                                                                          03/20/92       68.00  F4

12/18/91    263125  EE       251625  EE      11800      514.42      193.09      262.23     12/18/91       69.00  F4     524.32
                                                                                          10/21/91     -514.42  99

09/17/91    251625  EE       240375  EE      11250     2048.52      188.89      256.53     09/17/91       69.00  F4     514.42
                                                                                          07/30/91    -2048.52  99

06/19/91    240375  EE       229000  EE      11375     1486.24      190.99      259.38     06/19/91       69.00  F4    2048.52
                                                                                          06/19/91       42.91  96

03/20/91    229000  EE       217375  EE      11625      940.59      192.35      258.62     03/20/91       69.00  F4    1486.24
                                                                                          03/20/91       25.68  96

12/17/90    217375  EE       206000  EE      11375      477.40      172.58      217.39     12/17/90       66.00  F4     940.59
                                                                                          12/17/90        7.22  96

09/17/90    206000  EE       194000  075     12000       94.38      182.06      229.34     09/17/90       66.00  F4     477.40
                                                                                          07/09/90      -94.38  99

06/20/90    194000  075      182349  EE      11651     -370.59      176.81      222.96     06/20/90       66.00  F4      94.38
                                                                                          06/20/90       -0.80  50

03/21/90    182349  EE       171000  075     11349     -816.32      170.92      208.81     03/21/90       66.00  F4    -370.59

12/18/89    171000  075      199077  EE     -28077     1397.69     -415.91     -470.29     12/18/89       62.00  F4    -816.32
                                                                                          12/18/89        7.88  50
                                                                                          10/31/89    -1397.69  99

09/18/89    199077  EE       178966  EE      20111     1410.90      297.57      335.19     09/18/89       62.00  F4    1397.69
                                                                                          09/18/89       11.56  96
                                                                                          06/23/89     -719.53  99

06/19/89    178966  EE       159297  EE      19669      719.53      291.03      327.82     06/19/89       62.00  F4    1410.90
                                                                                          06/19/89       10.52  96

03/22/89    159297  EE       137860  59      21437      889.14      308.38      341.84     03/22/89       62.00  F4     719.53
                                                                                          03/22/89        7.31  96
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BESS                                BILLING HISTORY FOR A CONNECT                                       BILL_HIST_RPT
---------------------------------------------------------------------------------------------------------------------
DATE: 25-Jul-1994                                                                                      PAGE:    3
                                ACCOUNT NUMBER: 283874000
                                  SERVICE NAME: GEORGOPOULOS, CONSTANTINE
                               SERVICE ADDRESS: 712 COMMONWEALTH AVE
                                CITY STATE ZIP: BOSTON, MA 02215-2414
---------------------------------------------------------------------------------------------------------------------
BILL      CURRENT  RD   PREVIOUS  RD              BALANCE      WATER      SEWER   ---- PERIOD POSTINGS ----    BILL
DATE      READING  CD    READING  CD      CONS    FORWARD      CHARGE     CHARGE     DATE      AMOUNT    TV    AMOUNT
---------------------------------------------------------------------------------------------------------------------

                                                                                  02/27/89    -889.14    99

12/19/88   137860  59     104040  29     33820     478.13      416.21     416.18  12/19/88      56.75    F4    889.14
                                                                                  10/31/88    -478.13    99

09/19/88   104040  29      86310  EE     17730     351.55      218.81     221.20  09/19/88      56.75    F4    478.13
                                                                                  09/19/88       1.62    96
                                                                                  09/19/88     -20.25    50
                                                                                  08/18/88    -351.55    99

06/20/88    86310  EE      73430  31     12880      26.45      145.03     149.80  06/20/88      56.75    F4    351.55
                                                                                  06/20/88       0.17    98
                                                                                  05/18/88     -26.45    99

03/14/88    73430  31      74044  EE      8091     406.62       71.56      83.22  03/14/88      40.25    F4     26.45
                                                                                  01/04/88    -406.62    99
                                                                                  12/17/87     -91.28    83
                                                                                  12/17/87     -77.30    82

12/16/87    74044  EE      55000  43     19044     406.08      168.74     197.63  12/16/87      40.25    F4    406.62
                                                                                  10/16/87    -406.08    99

09/21/87    55000  43      38000  34     19000     537.41      168.40     197.43  09/21/87      40.25    F4    406.08
                                                                                  07/30/87    -537.41    99

06/29/87    36000  34      25090  EE     10910     286.20       96.08     110.64  06/29/87      39.98    F4    537.41
                                                                                  06/29/87       4.61    96
                                                                                  06/29/87      -0.10    50

04/01/87    25090  EE      13000  EE     12090    2686.74      103.82     111.80  04/01/87      38.75    F4    286.20
                                                                                  04/01/87      31.83    96
                                                                                  03/27/87   -2251.14    99
                                                                                  12/30/86    -329.50    83
                                                                                  12/30/86    -105.86    82
                                                                                  12/30/86      -0.24    84

12/29/86    13000  EE    1065370  EE    145710     237.97     1259.49    1388.50  12/29/86      38.75    F4   2686.74
                                                                                  08/22/86    -237.97    99

07/30/86  1065370  EE    1054190  EE     11180     174.45       96.01     103.38  07/30/86      38.58    F4    237.97
                                                                                  05/22/86    -174.45    99

05/05/86  1054190  EE    1045090  EE      9100     288.01       70.54      64.91  05/05/86      39.00    F4    174.45
                                                                                  03/14/86    -288.01    99

02/24/86  1045090  EE    1033260  EE     11830      74.47       90.94      82.47  02/24/86      39.00    F4    288.01
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DATE: 25-Jul-1994
                                              ACCOUNT NUMBER: 283874000
                                                SERVICE NAME: GEORGOPOULOS, CONSTANTINE
                                             SERVICE ADDRESS: 712 COMMONWEALTH AVE
                                              CITY STATE ZIP: BOSTON, MA 02215-2414
------------------------------------------------------------------------------------------------------------------------------
BILL       CURRENT  RD   PREVIOUS  RD               BALANCE        WATER         SEWER     ---- PERIOD POSTINGS ----        BILL
DATE       READING  CD    READING  CD       CONS    FORWARD        CHARGE        CHARGE          DATE      AMOUNT   TY      AMOUNT
------------------------------------------------------------------------------------------------------------------------------

                                                                                             02/24/86        1.13   96

11/25/85   1033260  EE    1020520  EE      12740    -118.96         97.94         88.81      11/25/85      157.16   F4       74.47
                                                                                             09/05/85     -150.48   99

08/19/85   1020520  EE    1009860  EE      10660     388.79         81.48         68.65      08/19/85        0.35   96     -118.96
                                                                                             07/22/85     -388.79   99
                                                                                             05/31/85     -269.44   99

05/29/85   1009860  EE    1001280  EE       8580     269.44         65.47         53.88                                    388.79

03/24/85   1001280  EE     992440  EE       8840     662.96         67.45         55.52      03/12/85     -505.11   99      269.44
                                                                                             01/16/85      -11.38   84

01/15/85    992440  EE     975930  EE      16510     421.93        125.97        103.68      01/15/85       11.38   96      662.96
09/10/84    975930  EE     944600  EE      31330     134.57        236.90        185.03      03/22/84     -134.57   99      421.93
02/27/84    944600  EE     934200  EE      10400     121.63         77.79         56.78      11/25/83     -121.63   99      134.57
11/21/83    934200  EE     924800  99       9400     557.00         70.31         51.32      11/21/83       11.65   96      121.63
                                                                                             11/21/83      -11.65   84
                                                                                             11/04/83     -557.00   99

09/13/83    924800  99     929300  EE          0     600.50          0.00          0.00      09/13/83       14.07   96      557.00
                                                                                             09/13/83      -34.18   82
                                                                                             09/13/83      -20.70   83
                                                                                             09/13/83       -2.69   84
                                                                                             07/22/83      118.76   85
                                                                                             06/29/83     -118.76   99

06/23/83    929300  EE     909200  EE      20100     624.59        150.35        109.75      06/23/83       15.81   96      600.50
                                                                                             05/20/83     -300.00   99

03/24/83    909200  EE     883500  99      25700     589.11        193.56        130.47      03/24/83       11.45   96      624.59
                                                                                             01/13/83     -300.00   99




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BESS                                          BILLING HISTORY FOR A CONNECT                                         BILL_HIST_RPT
------------------------------------------------------------------------------------------------------------------------------
DATE: 25-Jul-1994                                                                                                    PAGE:   1
                                          ACCOUNT NUMBER: 283867000
                                            SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                         SERVICE ADDRESS: 714 COMMONWEALTH AVE
                                          CITY STATE ZIP: BOSTON, MA 02215-2440
------------------------------------------------------------------------------------------------------------------------------
BILL       CURRENT  RD   PREVIOUS  RD             BALANCE       WATER        SEWER   ---- PERIOD POSTINGS ----       BILL
DATE       READING  CO    READING  CO     CONS    FORWARD       CHARGE       CHARGE       DATE      AMOUNT   TY     AMOUNT
------------------------------------------------------------------------------------------------------------------------------

07/01/94     97900  104     97516  EE      384      76.47         7.65        13.09   07/01/94       -0.52   50      20.22
                                                                                      06/28/94      -76.47   99

05/27/94     97516  EE      95500  104    2016     -33.43        40.23        69.67                                  78.47

05/02/94     95500  104     96044  EE     -544     684.95       -10.83       -18.54   05/02/94     -216.26   99     -33.43
                                                                                      05/02/94       -1.87   50
                                                                                      04/05/94     -470.88   99

03/29/94     96044  EE      92100  025    3944     576.41        78.82       137.44   03/02/94     -107.72   99     684.95

03/01/94     92100  025     83580  EE     8520     107.72       170.72       300.16   03/01/94       -2.19   50     576.41

01/28/94     83580  EE      81600  151    1980      81.02        39.49        68.23   01/26/94      -81.02   99     107.72

12/27/93     81600  151     80112  EE     1488     214.15        29.68        51.34   12/21/93      -87.66   99      81.02
                                                                                      12/06/93     -126.49   99

11/29/93     80112  EE      78500  093    1612     126.49        32.15        55.51                                 214.15

11/01/93     78500  093     76180  EE     2320     112.68        48.30        80.23   11/01/93       -0.04   50     126.49
                                                                                      10/21/93      -58.53   99
                                                                                      09/30/93      -54.15   99

09/29/93     76180  EE      75100  059    1080      54.15        21.52        37.01                                 112.68

09/01/93     75100  059     74100  EE     1000     184.55        19.92        34.24   09/01/93       -0.01   50      54.15
                                                                                      08/16/93      -65.07   99
                                                                                      08/02/93     -119.48   99

07/29/93     74100  EE      72900  104    1200     119.48        23.91        41.16                                 184.55

07/01/93     72900  104     70703  EE     2197      53.63        43.84        75.89   07/01/93       -0.25   50     119.48
                                                                                      06/16/93      -53.63   99

05/28/93     70703  EE      69713  EE      990      53.63        19.72        33.91   05/18/93      -53.63   99      53.63

04/28/93     69713  EE      68723  EE      990      55.42        19.72        33.91   04/20/93      -55.42   99      53.63

03/29/93     68723  EE      67700  056    1023     151.65        20.38        35.04   03/15/93      -45.49   99      55.42
                                                                                      03/08/93     -106.16   99

03/01/93     67700  056     66865  EE      835     106.16        18.63        28.58   03/01/93        0.28   50     151.65

01/29/93     66865  EE      64800  075    2065     146.20        40.33        65.83   01/15/93     -146.20   99     106.16

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DATE: 25-Jul-1994                                                                                            PAGE:    2
                                        ACCOUNT NUMBER: 283867000
                                          SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                       SERVICE ADDRESS: 714 COMMONWEALTH AVE
                                        CITY STATE ZIP: BOSTON, MA 02215-2440
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BILL      CURRENT  RD   PREVIOUS  RD             BALANCE      WATER      SEWER    ---- PERIOD POSTINGS ----     BILL
DATE      READING  CD    READING  CD     CONS    FORWARD     CHARGE     CHARGE       DATE      AMOUNT   TV    AMOUNT
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12/03/92    64800  075     61800  075    3000     121.67      57.46      88.74    10/23/92    -121.67   99    146.20

09/17/92    61800  075     59300  075    2500      55.21      47.87      73.80    07/31/92     -55.21   99    121.67

06/24/92   159300  075     58208  EE     1092     212.22      20.90      32.13    06/24/92       2.18   50     55.21
                                                                                  04/27/92    -212.22   99

03/20/92    58208  EE      53700  07     4508     176.78      84.40     127.82    01/30/92    -176.78   99    212.22

12/18/91    53700  07      49200  075    4500     117.52      75.38     101.40    10/09/91    -117.52   99    176.78

09/17/91    49200  075     46200  075    3000     158.00      50.21      67.31    07/17/91    -158.00   99    117.52

06/19/91    46200  075     42219  EE     3981     307.65      66.69      89.68    06/19/91       1.63   50    158.00
                                                                                  04/22/91    -307.65   99

03/20/91    42219  EE      34200  075    8019     256.64     131.87     175.78    01/28/91    -256.64   99    307.65

12/17/90    34200  075     26700  075    7500     215.38     113.66     142.48    12/17/90       0.50   96    256.64
                                                                                  11/08/90    -215.38   99

09/17/90    26700  075     20400  075    6300     232.10      95.44     119.48    09/17/90       0.46   96    215.38
                                                                                  08/10/90    -232.10   99

06/20/90    20400  075     13600  075    6800     152.66     103.03     129.07    04/24/90    -152.66   99    232.10

03/21/90    13600  075      9000  075    4600     201.07      69.10      83.56    01/16/90    -201.07   99    152.66

12/18/89     9000  075      2544  EE     6456      75.50      95.19     105.89    12/18/89      -0.01   50    201.07
                                                                                  10/17/89     -75.50   99

09/18/89     2544  EE     487810  EE     2440     171.67      35.91      39.59    07/21/89    -171.67   99     75.50

06/19/89   487810  EE     482292  EE     5518     180.44      81.33      90.34    04/24/89    -180.44   99    171.67

03/22/89   482292  EE     476278  59     6014     192.62      86.17      94.21    03/22/89       0.06   96    180.44
                                                                                  02/03/89    -192.62   99

12/19/88   476278  59     468382  EE     7896     126.19      96.83      95.79    11/01/88    -126.19   99    192.62

09/19/88   468382  EE     463195  EE     5187     130.77      63.56      62.63    07/22/88    -130.77   99    126.19

06/20/88   463195  EE     457609  EE     5586      96.58      65.13      65.64    04/13/88     -96.58   99    130.77

03/14/88   457609  EE     452536  EE     5073      99.83      44.79      51.79    01/26/88     -99.83   99     96.58

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DATE: 25-Jul-1994

ACCOUNT NUMBER: 283867000
SERVICE NAME: BOSTON UNV PHYSICAL PLANT
SERVICE ADDRESS: 714 COMMONWEALTH AVE
CITY STATE ZIP: BOSTON, MA 02215-2440

BILL DATE	CURRENT READING	RD CD	PREVIOUS READING	RD CD	CONS	BALANCE FORWARD	WATER CHARGE	SEWER CHARGE	---- PERIOD POSTINGS ---- DATE	AMOUNT	TY	BILL AMOUNT
12/16/87	452536	EE	447292	43	5244	90.85	46.30	53.53	10/28/87	-90.85	99	99.83
09/21/87	447292	43	442559	EE	4733	93.92	41.80	48.35	09/21/87 09/21/87 09/15/87	1.02 -0.32 -93.92	96 50 99	90.85
06/29/87	442559	EE	437575	EE	4984	253.65	43.82	50.10	05/08/87 04/17/87	-94.83 -158.82	99 99	93.92
04/01/87	437575	EE	432367	EE	5208	158.82	44.63	47.69	04/01/87	2.51	96	253.65
12/29/86	432367	EE	423407	60	8960	89.43	76.78	82.04	08/14/86	-89.43	99	158.82
07/23/86	423407	60	418170	60	5237	97.12	43.91	45.52	05/23/86	-97.12	99	89.43
04/14/86	418170	60	411521	25	6649	79.64	51.04	46.08	03/10/86	-79.64	99	97.12
02/17/86	411521	25	406062	51	5459	12.73	41.88	37.76	12/17/85	-12.73	99	79.64
11/13/85	406062	51	401139	51	4923	-59.11	37.77	34.07				12.73
08/19/85	401139	51	405354	EE	-4215	70.69	-32.19	-26.92	06/26/85	-70.69	99	-59.11
05/29/85	405354	EE	400272	EE	5082	72.83	38.78	31.91	04/18/85	-72.83	99	70.69
03/24/85	400272	EE	395036	EE	5236	136.02	39.95	32.88	03/05/85	-136.02	99	72.83
01/15/85	395036	EE	385257	EE	9779	249.92	74.61	61.41	10/04/84	-249.92	99	136.02
09/10/84	385257	EE	366700	99	18557	165.63	140.32	109.80	03/14/84	-165.63	99	249.92
02/27/84	366700	99	353900	EE	12800	71.17	95.74	69.89	12/14/83	-71.17	99	165.63
11/21/83	353900	EE	348400	EE	5500	102.22	41.14	30.03	09/27/83	-102.22	99	71.17
09/13/83	348400	EE	340500	EE	7900	91.88	59.09	43.13	07/13/83	-91.88	99	102.22
06/23/83	340500	EE	333400	EE	7100	574.16	53.11	38.77	04/19/83	-574.16	99	91.88
03/24/83	333400	EE	324300	EE	9100	435.59	68.54	46.19	03/24/83	23.84	96	574.16

DATE: 25-Jul-1994

ACCOUNT NUMBER: 283853000
SERVICE NAME: BOSTON UNV PHYSICAL PLANT
SERVICE ADDRESS: 718 COMMONWEALTH AVE
CITY STATE ZIP: BOSTON, MA 02215-2423

BILL DATE	CURRENT READING	RD CD	PREVIOUS READING	RD CD	CONS	BALANCE FORWARD	WATER CHARGE	SEWER CHARGE	PERIOD POSTINGS DATE	PERIOD POSTINGS AMOUNT	TY	BILL AMOUNT
07/01/94	311510	EE	304895	EE	6615	281.06	132.36	231.73	07/01/94 06/28/94	29.40 -281.06	F4 99	393.49
05/27/94	304895	EE	300170	EE	4725	382.25	94.54	165.52	05/27/94 05/27/94	-382.25 21.00	99 F4	281.06
05/02/94	300170	EE	293744	EE	6426	674.55	128.58	225.11	05/02/94 05/02/94 04/05/94	-314.79 28.56 -359.76	99 F4 99	382.25
03/29/94	293744	EE	288452	EE	5292	764.49	105.89	185.38	03/29/94 03/02/94	23.62 -404.73	F4 99	674.55
03/01/94	288452	EE	282404	EE	6048	404.73	121.01	211.87	03/01/94	26.88	F4	764.49
01/28/94	282404	EE	275600	151	6804	118.30	136.14	238.35	01/28/94 01/26/94	30.24 -118.30	F4 99	404.73
→ 12/27/93	275600	151	273781	EE	1819	933.10	36.30	62.89	12/27/93 12/27/93 12/21/93 12/06/93	-1.05 20.16 -455.70 -477.40	50 F4 99 99	118.30
11/29/93	273781	EE	266000	093	7781	477.40	155.86	273.80	11/29/93	26.04	F4	933.10
→ 11/01/93	266000	093	257830	029	8170	1560.15	163.68	287.68	11/01/93 10/21/93 09/30/93	26.04 -345.49 -1214.66	F4 99 99	477.40
09/29/93	257830	029	252000	059	5830	1214.66	116.68	204.45	09/29/93	24.36	F4	1560.15
09/01/93	252000	059	230584	EE	21416	487.00	430.27	765.17	09/01/93 09/01/93 08/18/93 08/02/93	-7.86 26.88 -219.94 -267.06	50 F4 99 99	1214.66
07/29/93	230584	EE	227000	EE	3584	267.06	71.62	124.80	07/29/93	23.52	F4	487.00
07/01/93	227000	EE	222648	EE	4352	235.64	86.98	151.54	07/01/93 06/18/93	28.56 -235.64	F4 99	267.06
05/28/93	222648	EE	218808	EE	3840	235.64	76.73	133.71	05/28/93 05/18/93	25.20 -235.64	F4 99	235.64
04/28/93	218808	EE	214968	EE	3840	243.50	76.73	133.71	04/28/93 04/20/93	25.20 -243.50	F4 99	235.64

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BESS                                  BILLING HISTORY FOR A CONNECT                                   BILL_HIST_RPT
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DATE: 25-Jul-1994                                                                                      PAGE:     2
                                   ACCOUNT NUMBER: 283853000
                                     SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                  SERVICE ADDRESS: 718 COMMONWEALTH AVE
                                   CITY STATE ZIP: BOSTON, MA 02215-2423
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BILL      CURRENT  RD   PREVIOUS  RD              BALANCE     WATER     SEWER    ---- PERIOD POSTINGS ----      BILL
DATE      READING  CO    READING  CO      CONS    FORWARD    CHARGE    CHARGE        DATE       AMOUNT  TY     AMOUNT
-------------------------------------------------------------------------------------------------------------------

03/29/93   214968  EE     211000  056     3968     655.14     79.29    138.17    03/29/93      26.04  F4     243.50
                                                                                 03/15/93    -178.61  99
                                                                                 03/08/93    -476.53  99

03/01/93   211000  056    208201  EE      2799     476.53     55.89     97.10    03/01/93       2.10  50     655.14
                                                                                 03/01/93      23.52  F4

01/29/93   208201  EE     200000  075     8201     337.13    160.70    265.97    01/29/93      49.86  F4     476.53
                                                                                 01/15/93    -337.13  99

12/03/92   200000  075    194415  EE      5585     739.26    107.15    166.84    12/03/92      63.75  F4     337.13
                                                                                 12/03/92      -0.41  50
                                                                                 10/23/92    -739.26  99

09/17/92   194415  EE     180900  EE     13515     869.73    259.78    407.23    09/17/92      72.25  F4     739.26
                                                                                 07/31/92    -869.73  99

06/24/92   180900  EE     165000  043    15900     984.59    305.63    479.10    06/24/92      85.00  F4     869.73
                                                                                 04/27/92    -964.59  99

03/20/92   165000  043    145082  EE     19918     572.08    376.36    531.79    03/20/92      64.60  F4     964.59
                                                                                 03/20/92     -58.16  50
                                                                                 01/30/92    -572.08  99

12/18/91   145082  EE     132388  EE     12696     599.42    213.21    289.87    12/18/91      69.00  F4     572.08
                                                                                 10/09/91    -599.42  99

09/17/91   132386  EE     119000  075    13386     374.94    224.80    305.62    09/17/91      69.00  F4     599.42
                                                                                 07/17/91    -374.94  99

06/19/91   119000  075    111335  EE      7665     699.74    128.58    173.91    06/19/91      69.00  F4     374.94
                                                                                 06/19/91       3.45  50
                                                                                 04/22/91    -699.74  99

03/20/91   111335  EE      95000  075    16335     617.33    289.11    361.83    03/20/91      69.00  F4     899.74
                                                                                 01/28/91    -617.33  99

12/17/90    95000  075  -  79000  075    16000     409.16    243.00    307.38    12/17/90      66.00  F4     617.33
                                                                                 12/17/90       0.96  96
                                                                                 11/08/90    -409.16  99

09/17/90    79000  075     69000  075    10000     373.88    151.66    190.76    09/17/90      66.00  F4     409.16
                                                                                 09/17/90       0.74  96
                                                                                 08/10/90    -373.88  99

06/20/90    69000  075     60000  075     9000     234.33    136.46    171.42    06/20/90      66.00  F4     373.88
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BESS                                    BILLING HISTORY FOR A CONNECT                                 BILL_HIST_RPT
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DATE: 25-Jul-1994                                                                                          PAGE:   3
                                  ACCOUNT NUMBER: 283653000
                                    SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                 SERVICE ADDRESS: 718 COMMONWEALTH AVE
                                  CITY STATE ZIP: BOSTON, MA 02215-2423
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BILL       CURRENT  RD    PREVIOUS  RD                BALANCE       WATER        SEWER    ---- PERIOD POSTINGS ----     BILL
DATE       READING  CD     READING  CD       CONS     FORWARD       CHARGE       CHARGE        DATE     AMOUNT    TV    AMOUNT
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                                                                                          04/24/90    -234.33   99

03/21/90     60000  075      55792  EE       4208     1129.25        63.26        76.74   03/21/90      66.00   F4    234.33
                                                                                          03/21/90      28.33   50
                                                                                          01/16/90   -1129.25   99

12/18/89     55792  EE       22000  076     33792     2940.50       500.68       566.57   12/18/89      62.00   F4   1129.25
                                                                                          10/17/89   -2940.50   99

09/18/89     22000  076    4289402  EE      90089     1051.43      1339.55      1538.95   09/18/89      62.00   F4   2940.50
                                                                                          07/07/89   -1051.43   99

06/19/89   4289402  EE     4258074  EE      31328     1101.89       464.17       525.26   06/19/89      62.00   F4   1051.43
                                                                                          04/24/89   -1101.89   99

03/22/89   4258074  EE     4223930  59      34144      974.97       491.85       547.72   03/22/89      62.00   F4   1101.89
                                                                                          03/22/89       0.32   96
                                                                                          02/03/89    -974.97   99

12/19/88   4223930  59     4186800  EE      37130      791.41       457.83       461.03   12/19/88      56.75   F4    974.97
                                                                                          12/19/88      -0.64   50
                                                                                          11/01/88    -791.41   99

09/19/88   4186800  EE     4157021  25      29779      841.45       366.81       367.85   09/19/88      56.75   F4    791.41
                                                                                          07/15/88    -841.45   99

06/20/88   4157021  25     4122891  EE      34130      538.20       398.88       410.52   06/20/88      56.75   F4    841.45
                                                                                          06/20/88     -24.70   50
                                                                                          04/13/88    -538.20   99

03/14/88   4122891  EE     4097081  EE      25810      482.25       228.91       269.04   03/14/88      40.25   F4    538.20
                                                                                          01/26/88    -482.25   99

12/16/87   4097081  EE     4074171  EE      22910      584.43       203.19       238.81   12/16/87      40.25   F4    482.25
                                                                                          10/28/87    -584.43   99

09/28/87   4074171  EE     4046041  34      28130      892.17       249.48       293.23   09/28/87      40.25   F4    584.43
                                                                                          09/28/87       1.47   96
                                                                                          08/18/87    -892.17   99

06/29/87   4046041  34     4001636  EE      44405     1205.80       392.75       459.44   06/29/87      39.98   F4    892.17
                                                                                          05/08/87    -474.21   99
                                                                                          04/17/87    -731.59   99

04/01/87   4001636  EE     3978014  EE      23822      731.59       203.29       220.62   04/01/87      38.75   F4   1205.80
                                                                                          04/01/87      11.55   96
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DATE: 25-Jul-1994                                                                                                     PAGE:   4
                                           ACCOUNT NUMBER: 283853000
                                             SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                          SERVICE ADDRESS: 718 COMMONWEALTH AVE
                                           CITY STATE ZIP: BOSTON, MA 02215-2423
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BILL      CURRENT  RD    PREVIOUS  RD              BALANCE     WATER      SEWER      ---- PERIOD POSTINGS ----       BILL
DATE      READING  CD     READING  CD     CONS     FORWARD     CHARGE     CHARGE        DATE      AMOUNT   TY       AMOUNT
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12/29/86  3978014  EE     3939406  EE     38608     431.76     332.26     360.58     12/29/86      38.75   F4       731.59
                                                                                     08/26/86    -431.76   99

07/30/86  3939406  EE     3917562  EE     21844     447.46     187.99     204.01     07/30/86      38.58   F4       431.76
                                                                                     07/30/86       1.18   98
                                                                                     06/27/86    -447.46   99

05/05/86  3917562  EE     3890130  25     27432     600.44     212.53     195.93     05/05/86      39.00   F4       447.46
                                                                                     03/20/86    -600.44   99

02/24/86  3890130  25     3852377  EE     37753     394.58     292.01     269.43     02/24/86      39.00   F4       600.44
                                                                                     12/27/85    -394.58   99

11/25/85  3852377  EE     3836207  EE     16170     254.89     124.39     113.03     11/25/85     157.16   F4       394.58
                                                                                     09/16/85    -254.89   99

08/19/85  3836207  EE     3818057  99     18150     932.21     138.68     116.21     06/26/85    -932.21   99       254.89
05/29/85  3818057  99     3751040  EE     67017     156.07     511.34     420.87     04/16/85    -156.07   99       932.21
03/24/85  3751040  EE     3739820  EE     11220     291.49      85.61      70.46     03/05/85    -291.49   99       156.07
01/15/85  3739820  EE     3718865  EE     20955     535.54     159.89     131.60     10/04/84    -535.54   99       291.49
09/10/84  3718865  EE     3679100  EE     39765     170.81     300.69     234.85     03/14/84    -170.81   99       535.54
02/27/84  3679100  EE     3665900  EE     13200     153,98      98.74      72.07     12/14/83    -153.98   99       170.81
11/21/83  3665900  EE     3654000  EE     11900     219.98      89.01      64.97     09/27/83    -219.98   99       153.98
09/13/83  3654000  EE     3637000  EE     17000     196.69     127.16      92.82     07/13/83    -196.69   99       219.98
06/23/83  3637000  EE     3621800  EE     15200     245.89     113.70      82.99     04/08/83    -245.89   99       196.69
03/24/83  3821800  EE     3802300  EE     19500     187.35     146.87      99.02     12/17/82    -187.35   99       245.89



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BESS                                              BILLING HISTORY FOR A CONNECT                                             BILL_HIST_RPT
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DATE: 25-Jul-1994                                                                                                          PAGE:   2
                                          ACCOUNT NUMBER: 283639001
                                            SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                         SERVICE ADDRESS: 728 COMMONWEALTH AVE
                                          CITY STATE ZIP: BOSTON, MA 02215-2439
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BILL      CURRENT  RD    PREVIOUS  RD                BALANCE      WATER       SEWER     ---- PERIOD POSTINGS ----       BILL
DATE      READING  CD     READING  CD       CONS     FORWARD      CHARGE      CHARGE      DATE       AMOUNT    TY      AMOUNT
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                                                                                        05/03/93    -4415.86   99

04/07/93  2738129  EE     2660639  EE      77490     4857.45     1564.08     2826.58    04/07/93       25.20   F4     4415.86
                                                                                        03/30/93    -4857.45   99

03/08/93  2660639  EE     2575400  128     85239     8805.01     1720.49     3109.24    03/08/93    -2631.08   99     4857.45
                                                                                        03/08/93       27.72   F4
                                                                                        02/19/93    -6173.93   99

02/05/93  2575400  128    2529960  EE      45440    24235.64      916.65     1653.14    02/05/93       18.48   F4     8805.01
                                                                                        02/05/93       42.81   50
                                                                                        01/15/93   -18061.71   99

01/12/93  2529960  EE     2413200  075    116760    18061.71     2292.54     3845.81    01/12/93       35.58   F4    24235.64

12/03/92  2413200  075    2060650  041    352550     4980.92     6844.67    11111.74    12/03/92      105.40   F4    18061.71
                                                                                        10/23/92    -4980.92   99

09/17/92  2060650  041    1962662  EE      97988    12174.06     1902.19     3087.09    09/17/92       30.60   F4     4980.92
                                                                                        09/17/92      -38.96   50
                                                                                        07/31/92   -12174.06   99

06/24/92  1962662  EE     1721126  EE     241536    11645.74     4687.86     7603.30    06/24/92       81.60   F4    12174.06
                                                                                        06/11/92        0.00   45
                                                                                        04/27/92   -11645.74   99
                                                                                        03/21/92     -198.70   93

03/20/92  1721126  EE     1487138  EE     233988    13223.71     4461.18     7116.56    03/20/92       68.00   F4    11645.74
                                                                                        01/30/92   -13223.71   99

12/18/91  1487138  EE     1165090  031    322048     9397.64     5461.02     7693.69    12/18/91       69.00   F4    13223.71
                                                                                        10/09/91    -9397.64   99

09/17/91  1165090  031     936650  029    228440     3419.05     3873.34     5455.30    09/17/91       69.00   F4     9397.64
                                                                                        07/17/91    -3419.05   99

06/19/91   936650  029     855663  EE      80987    13229.72     1371.28     1922.46    06/19/91       69.00   F4     3419.05
                                                                                        06/19/91       56.31   50
                                                                                        04/22/91   -13229.72   99

03/20/91   855663  EE      525300  075    330363    11167.72     5497.18     7663.54    03/20/91       69.00   F4    13229.72
                                                                                        01/28/91   -11167.72   99

12/17/90   525300  075     212330  025    312970     2794.83     4799.30     6295.67    12/17/90       66.00   F4    11167.72
                                                                                        12/17/90        6.75   96
                                                                                        11/08/90    -2794.83   99

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DATE: 25-Jul-1994                                                                                       PAGE:  3
                                        ACCOUNT NUMBER: 283639001
                                          SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                       SERVICE ADDRESS: 728 COMMONWEALTH AVE
                                        CITY STATE ZIP: BOSTON, MA 02215-2439
----------------------------------------------------------------------------------------------------------------
BILL      CURRENT  RD   PREVIOUS  RD                BALANCE      WATER      SEWER   ---- PERIOD POSTINGS ----     BILL
DATE      READING  CD    READING  CD      CONS      FORWARD     CHARGE     CHARGE       DATE       AMOUNT  TY    AMOUNT
----------------------------------------------------------------------------------------------------------------

09/17/90   212330  025    134166  EE     78164     10890.56    1193.64    1542.73   09/17/90       36.98  50   2794.83
                                                                                    09/17/90       21.48  96
                                                                                    08/10/90   -10890.56  99

06/20/90   134166  EE    9826859  EE    307307     11333.29    4712.05    6178.51   04/24/90   -11333.29  99  10890.56
03/21/90  9826859  EE    9499290  075   327569     11024.62    4988.90    6346.39   01/16/90   -11024.62  99  11333.29
12/18/89  9499290  075   9161100  076   338190      5040.68    5049.09    5885.53   12/07/89       90.00  36  11024.62
                                                                                    10/17/89    -5040.68  99

09/18/89  9161100  076   9007000  EE    154100      7392.84    2295.65    2665.03   07/21/89    -7392.84  99   5040.68
                                                                                    06/21/89       90.00  36

06/19/89  9007000  EE    8777480  076   229520      6778.51    3422.32    3970.52   04/04/89    -6778.51  99   7392.84
03/20/89  8777480  076   8561860  59    215620      5773.11    3119.69    3557.25   03/20/89       26.57  96   6778.51
                                                                                    02/18/89    -5773.11  99
                                                                                    12/22/88       75.00  36

12/19/88  8561860  59    8332556  EE    229304      6369.91    2843.83    2929.28   11/01/88    -6369.91  99   5773.11
09/19/88  8332556  EE    8082490  25    250066      9305.14    3101.16    3193.76   07/18/88    -9305.14  99   6369.91
                                                                                    07/06/88       75.00  36

06/20/88  8082490  25    7667560  EE    414930      3632.48    4887.14    5187.50   06/20/88     -769.50  50   9305.14
                                                                                    04/13/88    -3632.48  99

03/14/88  7667560  EE    7482796  EE    184764      3274.34    1649.09    1983.39   01/28/88    -3274.34  99   3632.48
12/16/87  7482796  EE    7318792  EE    164004      3964.77    1463.80    1760.54   12/15/87       50.00  36   3274.34
                                                                                    10/28/87    -3964.77  99

09/28/87  7318792  EE    7117420  34    201372      3509.56    1797.33    2161.67   09/28/87        5.77  96   3964.77
                                                                                    08/18/87    -3509.56  99

06/29/87  7117420  34    6938050  25    179370      5271.60    1588.24    1871.32   06/12/87       50.00  36   3509.56
                                                                                    04/17/87    -5271.60  99

03/25/87  6938050  25    6653990  65    284060      7820.71    2463.12    2745.62   03/25/87       12.86  96   5271.60
                                                                                    02/03/87    -7820.71  99
                                                                                    12/19/86       50.00  36

12/15/86  6653990  65    6228250  EE    425740      6639.64    3693.98    4126.73   08/28/86    -6639.64  99   7820.71
07/30/86  6228250  EE    5856970  60    371280      4301.79    3158.76    3430.88   07/10/86       50.00  36   6639.64
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BESS                                     BILLING HISTORY FOR A CONNECT                                        BILL_HIST_RPT
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DATE: 25-Jul-1994                                                                                              PAGE:    4
                                      ACCOUNT NUMBER: 283639001
                                        SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                     SERVICE ADDRESS: 728 COMMONWEALTH AVE
                                      CITY STATE ZIP: BOSTON, MA 02215-2439
--------------------------------------------------------------------------------------------------------------------------
BILL      CURRENT  RD   PREVIOUS  RD              BALANCE        WATER       SEWER     ---- PERIOD POSTINGS ----      BILL
DATE      READING  CD    READING  CD      CONS    FORWARD        CHARGE      CHARGE       DATE      AMOUNT   TY      AMOUNT
--------------------------------------------------------------------------------------------------------------------------

                                                                                       05/23/86   -4301.79   99

04/14/86  5856970  60   5571450   25    285520    3475.24       2220.81     2080.98    03/10/86   -3475.24   99     4301.79

02/17/86  5571450  25   5340330   51    231120    2615.77       1796.14     1679.10    12/17/85   -2615.77   99     3475.24

11/13/85  5340330  51   5166220   51    174110    1465.22       1352.59     1283.18    09/16/85   -1465.22   99     2615.77

08/19/85  5166220  51   5061830   99    104390    5687.66        798.00      667.22    06/26/85   -5687.66   99     1465.22

05/29/85  5061830  99   4652940   99    408890    1501.31       3119.83     2567.83    04/09/85   -1501.31   99     5687.66

03/10/85  4652940  99   4545010   99    107930     471.21        823.51      677.80    12/07/84    -471.21   99     1501.31

11/07/84  4545010  99   4511135   EE     33875    7254.09        258.47      212.74    10/04/84   -7254.09   99      471.21

09/10/84  4511135  EE   3972500   99    538635    2049.69       4072.93     3181.16    03/14/84   -2049.69   99     7254.09

02/27/84  3972500  99   3814100   EE    158400    2082.04       1184.83      864.86    12/14/83   -2082.04   99     2049.69

11/21/83  3814100  EE   3653200   99    160900    1526.92       1203.53      878.51    09/27/83   -1526.92   99     2082.04

09/13/83  3653200  99   3535200   99    118000    4723.10        882.64      644.28    07/13/83   -4723.10   99     1526.92

06/23/83  3535200  99   3170200   99    365000    1027.59       2730.20     1992.90    04/08/83   -1027.59   99     4723.10

03/24/83  3170200  99   3088700   EE     81500    2540.47        613.83      413.76    12/17/82   -2540.47   99     1027.59






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BESS                                     BILLING HISTORY FOR A CONNECT                                          BILL_HIST_RPT
--------------------------------------------------------------------------------------------------------------------------
DATE: 25-jul-1994                                                                                              PAGE:    1
                                  ACCOUNT NUMBER: 283639001
                                    SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                 SERVICE ADDRESS: 728 COMMONWEALTH AVE
                                  CITY STATE ZIP: BOSTON, MA 02215-2439
--------------------------------------------------------------------------------------------------------------------------
BILL       CURRENT  RD   PREVIOUS  RD                BALANCE       WATER       SEWER     ---- PERIOD POSTINGS ----     BILL
DATE       READING  CD    READING  CD       CONS     FORWARD       CHARGE      CHARGE        DATE      AMOUNT    TV    AMOUNT
--------------------------------------------------------------------------------------------------------------------------
             2
07/08/94    718360  122    683300  150      35060    5106.95       705.61     1262.02     07/08/94      28.56   F4   1915.20
                                                                                          06/28/94   -5106.95   99
           3932419                                                                        06/08/94     -80.99   93

06/07/94    683300  150    593700  150      89600    6321.36      1808.95     3271.96     06/07/94      26.04   F4   5106.95
                                                                                          05/27/94   -6321.36   99

05/09/94    593700  150    483000  150     110700    5548.54      2236.96     4059.20     05/09/94      25.20   F4   6321.36
                                                                                          05/02/94   -5548.54   99

04/11/94    483000  150    385700  150      97300    5518.95      1984.94     3557.86     04/11/94      26.04   F4   5548.54
                                                                                          04/05/94   -5518.95   99

03/10/94    385700  150    289000  150      96700    3973.71      1953.57     3541.86     03/10/94      23.52   F4   5518.95
                                                                                          03/02/94   -3973.71   99

02/08/94    289000  150    219250  150      69750    8550.51      1407.38     2540.29     02/08/94      26.04   F4   3973.71
                                                                                          01/31/94   -3933.75   99
                                                                                          01/26/94   -4616.76   99

01/11/94    219250  150    150200  150      69050    4616.76      1393.22     2514.49     01/11/94      26.04   F4   8550.51
12/08/93    150200  150     69160  128      81040    8636.62      1636.90     2957.43     12/08/93      28.20   F4   4616.76
                                                                                          12/06/93   -3941.10   99
                                                                                          11/17/93   -4695.52   99
                                                                                          11/06/93      -1.77   93

11/05/93     69160  128   3214059  EE       69160    4695.52      1395.92     2522.50     11/05/93      22.68   F4   8636.62
10/07/93   3214059  EE    3126480  060      87579    2029.69      1767.35     3191.53     10/07/93      31.08   F4   4895.52
                                                                                          09/30/93   -2029.69   99
                                                                                          09/11/93    -294.44   93

✓09/10/93  3126480  060   3090810  EE       35670    4967.35       718.65     1290.04     09/10/93      21.00   F4   2029.69
                                                                                          08/31/93   -4967.35   99

08/06/93   3090810  EE    3003660  128      87150    5626.24      1759.50     3182.65     08/06/93      25.20   F4   4967.35
                                                                                          08/02/93   -5626.24   99

07/09/93   3003660  128   2904950  128      98710    4932.22      1992.89     3604.79     07/09/93      28.56   F4   5626.24
                                                                                          07/06/93   -4932.22   99

06/07/93   2904950  128   2818420  128      86530    4576.30      1747.08     3160.78     06/07/93      24.36   F4   4932.22
                                                                                          06/03/93   -4576.30   99

05/08/93   2818420  128   2738129  EE       80291    4415.86      1620.98     2931.80     05/08/93      23.52   F4   4576.30
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BESS                                     BILLING HISTORY FOR A CONNECT                                          BILL_HIST_RPT
---------------------------------------------------------------------------------------------------------------------------
DATE: 25-Jul-1994                                                                                               PAGE:    1
                                        ACCOUNT NUMBER: 283730000
                                          SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                       SERVICE ADDRESS: 110 CUMMINGTON ST
                                        CITY STATE ZIP: BOSTON, MA 02215-2407
---------------------------------------------------------------------------------------------------------------------------
BILL      CURRENT  RD  PREVIOUS  RD             BALANCE      WATER      SEWER   ---- PERIOD POSTINGS ----       BILL
DATE      READING  CD  READING   CD    CONS     FORWARD      CHARGE     CHARGE      DATE       AMOUNT   TY     AMOUNT
---------------------------------------------------------------------------------------------------------------------------

07/11/94  716315   EE  685715    EE    30600     1640.85     615.57    1099.27    07/11/94      28.56  F4    1743.40
                                                                                  06/28/94   -1640.85  99

06/07/94  685715   EE  656915    072   28800     1341.54     579.36    1034.61    06/07/94      26.88  F4    1640.86
                                                                                  05/27/94   -1341.54  99

05/09/94  656915   072 633377    EE    23538     1706.14     473.38     844.64    05/09/94      23.52  F4    1341.54
                                                                                  05/02/94   -1706.14  99

04/08/94  633377   EE  603425    072   29952     1066.47     602.62    1076.64    04/08/94      26.88  F4    1706.14
                                                                                  04/05/94   -1066.47  99

03/10/94  603425   072 584740    EE    18685     1568.11     375.40     667.55    03/10/94      23.52  F4    1066.47
                                                                                  03/02/94   -1568.11  99

02/07/94  584740   EE  557200    EE    27540     3888.22     554.25     991.18    02/07/94      22.68  F4    1568.11
                                                                                  01/31/94   -2323.12  99
                                                                                  01/26/94   -1565.10  99

01/11/94  557200   EE  516400    029   40800     1565.10     821.11    1468.41    01/11/94      33.60  F4    3888.22

12/06/93  516400   029 488913    072   27487    14912.29     553.18     989.24    12/06/93   -3256.51  99    1565.10
                                                                                  12/06/93      22.68  F4
                                                                                  12/01/93  -11655.78  99

11/08/93  488913   072 431692    029   57221    11655.78    1151.99    2062.52    11/08/93      42.00  F4   14912.29

10/07/93  431692   029 212474    EE   219218      492.22    4450.95    8222.06    10/07/93   -1023.11  50   11655.78
                                                                                  10/07/93       5.88  F4
                                                                                  09/30/93    -492.22  99

09/09/93  212474   EE  204076    EE     8398      390.88     168.21     295.45    09/09/93      28.56  F4     492.22
                                                                                  08/31/93    -390.88  99

08/06/93  204076   EE  197407    EE     6669      463.27     133.68     234.62    08/06/93      22.68  F4     390.88
                                                                                  08/02/93    -463.27  99

07/10/93  197407   EE  189503    EE     7904      419.84     158.32     278.07    07/10/93      26.88  F4     463.27
                                                                                  07/06/93    -419.84  99

06/08/93  189503   EE  182340    EE     7163      492.22     143.48     252.00    06/08/93      24.36  F4     419.84
                                                                                  06/03/93    -492.22  99

05/10/93  182340   EE  173942    EE     8398      405.36     168.21     295.45    05/10/93      28.56  F4     492.22
                                                                                  05/03/93    -405.36  99

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BESS                                     BILLING HISTORY FOR A CONNECT                                       BILL_HIST_RPT
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DATE: 25-Jul-1994                                                                                            PAGE:    2
                                        ACCOUNT NUMBER: 283730000
                                          SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                       SERVICE ADDRESS: 110 CUMMINGTON ST
                                        CITY STATE ZIP: BOSTON, MA 02215-2407
-----------------------------------------------------------------------------------------------------------------------
BILL       CURRENT  RD   PREVIOUS  RD                BALANCE      WATER       SEWER     ---- PERIOD POSTINGS ----     BILL
DATE       READING  CD    READING  CD        CONS    FORWARD      CHARGE      CHARGE        DATE      AMOUNT   TY     AMOUNT
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04/06/93    173942  EE     167026  EE        6916     405.36      138.53      243.31    04/06/93       23.52   F4     405.36
                                                                                        03/30/93     -405.36   99

03/09/93    167026  EE     160110  EE        6916     946.08      138.53      243.31    03/09/93       23.52   F4     405.36
                                                                                        03/08/93     -405.36   99
                                                                                        02/19/93     -540.72   99

02/09/93    160110  EE     153194  EE        6916    1549.95      138.53      243.31    02/09/93       23.52   F4     946.08
                                                                                        01/15/93    -1009.23   99

01/12/93    153194  EE     143314  EE        9880    1009.23      192.55      314.29    01/12/93       33.88   F4    1549.95
12/03/92    143314  EE     124295  EE       19019    1114.09      366.24      577.54    12/03/92       65.45   F4    1009.23
                                                                                        10/23/92    -1114.09   99

09/17/92    124295  EE     103300  EE       20995    1310.69      404.30      637.54    09/17/92       72.25   F4    1114.09
                                                                                        07/31/92    -1310.69   99

06/24/92    103300  EE      78600  043      24700    2255.58      475.64      750.05    06/24/92       85.00   F4    1310.69
                                                                                        04/27/92    -2255.58   99

03/20/92     78600  043     30630  EE       47970     975.11      908.67     1420.83    03/20/92       64.60   F4    2255.58
                                                                                        03/20/92     -138.52   80
                                                                                        01/30/92     -975.11   99

12/18/91     30630  EE       7906  EE       22724     574.09      382.39      523.72    12/18/91       69.00   F4     975.11
                                                                                        10/09/91     -574.09   99

09/17/91      7906  EE    1156740  EE       12744     965.26      214.03      291.06    09/17/91       69.00   F4     574.09
                                                                                        07/17/91     -965.26   99

06/19/91   1156740  EE    1134263  EE       22477    1017.62      378.23      518.03    06/19/91       69.00   F4     965.26
                                                                                        04/22/91    -1017.62   99

03/20/91   1134263  EE    1109810  075      24453     944.32      403.47      545.15    03/20/91       69.00   F4    1017.62
                                                                                        01/28/91     -944.32   99

12/17/90   1109810  075   1084420  025      25390     343.29      386.19      491.33    12/17/90       66.00   F4     944.32
                                                                                        12/17/90        0.80   96
                                                                                        11/08/90     -343.29   99

09/17/90   1084420  025   1076346  EE        8074     415.06      122.40      153.68    09/17/90       66.00   F4     343.29
                                                                                        09/17/90        0.39   50
                                                                                        09/17/90        0.82   96
                                                                                        08/10/90     -415.06   99

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BESS                                      BILLING HISTORY FOR A CONNECT                                  BILL_HIST_RPT
---------------------------------------------------------------------------------------------------------------------
DATE: 25-Jul-1994                                                                                          PAGE:    3
                                         ACCOUNT NUMBER: 283730000
                                           SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                        SERVICE ADDRESS: 110 CUMMINGTON ST
                                         CITY STATE ZIP: BOSTON, MA 02215-2407
---------------------------------------------------------------------------------------------------------------------
BILL      CURRENT  RD   PREVIOUS  RD                BALANCE      WATER       SEWER    ---- PERIOD POSTINGS ----    BILL
DATE      READING  CD    READING  CD      CONS      FORWARD      CHARGE      CHARGE       DATE      AMOUNT   TY    AMOUNT
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06/20/90  1076346  EE    1066154  EE     10192       429.34      154.58      194.48   06/20/90       66.00  F4    415.06
                                                                                      04/24/90     -429.34  99

03/21/90  1066154  EE    1055290  075    10864       413.44      163.59      199.75   03/21/90       66.00  F4    429.34
                                                                                      01/16/90     -413.44  99

12/18/89  1055290  075   1049764  EE      5526       609.32       81.45       90.50   12/18/89       62.00  F4    413.44
                                                                                      12/18/89       -0.51  50
                                                                                      12/08/89      180.00  36
                                                                                      10/17/89     -609.32  99

09/18/89  1049764  EE    1038025  EE     11739       445.47      173.35      193.97   09/18/89       62.00  F4    609.32
                                                                                      07/07/89     -445.47  99
                                                                                      06/21/89      180.00  36

06/19/89  1038025  EE    1025770  076    12255       559.97      180.97      202.50   06/19/89       62.00  F4    445.47
                                                                                      04/24/89     -559.97  99

03/22/89  1025770  076   1014210  59     11560       427.44      165.65      182.18   03/22/89       62.00  F4    559.97
                                                                                      03/22/89        0.14  96
                                                                                      02/03/89     -427.44  99
                                                                                      12/22/88      150.00  36

12/19/88  1014210  59     999096  EE     15114       486.70      185.80      185.11   12/19/88       56.75  F4    427.44
                                                                                      12/19/88       -0.22  50
                                                                                      11/01/88     -486.70  99

09/19/88   999096  EE     987650  25     11446       341.71      140.52      139.43   09/19/88       56.75  F4    488.70
                                                                                      07/15/88     -341.71  99
                                                                                      07/05/88      150.00  36

06/20/88   987650  25     975290  60     12360       164.73      140.52      144.44   06/20/88       56.75  F4    341.71
                                                                                      04/13/88     -164.73  99

03/14/88   975290  60     968760  59      6530       517.78       57.68       66.80   03/14/88       40.25  F4    164.73
                                                                                      01/26/88     -517.78  99

12/16/87   968760  59     949170  43     19590       981.05      173.68      203.85   12/16/87       40.25  F4    517.78
                                                                                      12/16/87       50.00  36
                                                                                      12/15/87       50.00  36
                                                                                      10/28/87     -981.05  99

09/28/87   949170  43     900960  EE     48210       392.53      428.56      507.98   09/28/87       40.25  F4    981.05
                                                                                      09/28/87        4.26  96
                                                                                      09/15/87     -392.53  99

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BESS                                    BILLING HISTORY FOR A CONNECT                                    BILL_HIST_RPT
------------------------------------------------------------------------------------------------------------------------
DATE: 25-Jul-1994                                                                                          PAGE:    4
                                        ACCOUNT NUMBER: 283730000
                                          SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                       SERVICE ADDRESS: 110 CUMMINGTON ST
                                        CITY STATE ZIP: BOSTON, MA 02215-2407
------------------------------------------------------------------------------------------------------------------------
BILL      CURRENT  RD   PREVIOUS  RD                BALANCE       WATER      SEWER   ---- PERIOD POSTINGS ----     BILL
DATE      READING  CD    READING  CD       CONS     FORWARD      CHARGE     CHARGE       DATE      AMOUNT    TY    AMOUNT
------------------------------------------------------------------------------------------------------------------------

06/29/87   900960  EE     889746  EE      11214      286.60       98.78     113.79   06/29/87       39.98   F4    392.53
                                                                                     06/29/87       39.98   F4
                                                                                     06/11/87      100.00   36
                                                                                     05/08/87     -286.60   99

04/01/87   889746  EE     878028  EE      11718      518.98      100.62     108.31   04/01/87       38.75   F4    286.60
                                                                                     04/01/87       38.75   F4
                                                                                     04/01/87        0.17   96
                                                                                     02/13/87     -518.98   99

12/29/86   878028  EE     858876  EE      19152      320.92      164.45     177.03   12/29/86       38.75   F4    518.98
                                                                                     12/29/86       38.75   F4
                                                                                     12/19/86       50.00   36
                                                                                     12/19/86       50.00   36
                                                                                     08/28/86     -320.92   99

07/30/86   858876  EE     848040  EE      10836      209.25       93.05     100.16   07/30/86       38.58   F4    320.92
                                                                                     07/30/86       38.58   F4
                                                                                     07/30/86        0.55   96
                                                                                     07/14/86       50.00   36
                                                                                     06/27/86     -209.25   99

05/05/86   848040  EE     839220  EE       8820      246.04       68.36      62.89   05/05/86       39.00   F4    209.25
                                                                                     05/05/86       39.00   F4
                                                                                     03/20/86     -246.04   99

02/24/86   839220  EE     827754  EE      11466      506.36       88.14      79.90   02/24/86       39.00   F4    246.04
                                                                                     02/24/86       39.00   F4
                                                                                     12/17/85     -506.36   99

11/25/85   827754  EE     814650  51      13104      169.71      100.73      91.31   11/25/85      157.16   F4    506.36
                                                                                     11/25/85      157.16   F4
                                                                                     09/09/85     -169.71   99

08/19/85   814650  51     802530  99      12120      389.39       92.56      77.15   06/14/85     -389.39   99    169.71
05/13/85   802530  99     787420  99      15110      327.82      115.29      94.89   05/13/85        2.97   96    389.39
                                                                                     04/09/85     -151.58   99

03/10/85   787420  99     776560  99      10860      176.24       82.86      68.20   03/10/85        0.52   96    327.82
01/15/85   776560  99     763890  99      12670      477.37       96.67      79.57   10/08/84     -477.37   99    176.24
09/10/84   763890  99     728900  EE      34990      251.03      265.53     211.84   03/14/84     -251.03   99    477.37
02/27/84   728900  EE     709500  99      19400      210.92      145.11     105.92   12/14/83     -210.92   99    251.03
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BESS                                    BILLING HISTORY FOR A CONNECT                                                    BILL_HIST_RPT
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DATE: 25-Jul-1994                                                                                                          PAGE:   5
                                     ACCOUNT NUMBER: 283730000
                                       SERVICE NAME: BOSTON UNV PHYSICAL PLANT
                                    SERVICE ADDRESS: 110 CUMMINGTON ST
                                     CITY STATE ZIP: BOSTON, MA 02215-2407
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BILL        CURRENT  RD    PREVIOUS  RD                BALANCE        WATER         SEWER      ---- PERIOD POSTINGS ----      BILL
DATE        READING  CD     READING  CD       CONS     FORWARD        CHARGE        CHARGE          DATE      AMOUNT   TY    AMOUNT
**********************************************************************************************************************************

11/21/83     709500  99      693200  EE      16300      194.10        121.92         89.00     09/27/83     -194.10   99    210.92

09/13/83     693200  EE      678200  EE      15000      223.86        112.20         81.90     07/13/83     -223.86   99    194.10

06/23/83     678200  EE      660900  99      17300      420.58        129.40         94.46     04/08/83     -420.58   99    223.86

03/24/83     660900  99      627800  99      33100      183.61        248.79        171.79     12/17/82     -183.61   99    420.58

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3 9999 06314 436 2